STUDY ON EFFECTIVENESS OF REVISED JONES CRITERIA (AHA 2015) IN DETECTING ACUTE RHEUMATIC FEVER CASES

DISSERTATION SUBMITTED FOR THE DEGREE OF

M.D BRANCH VII

(PAEDIATRIC MEDICINE)

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CHENNAI, TAMIL NADU

CERTIFICATE FROM THE DEAN

This is to certify that the dissertation entitled **"STUDY ON EFFECTIVENESS OF REVISED JONES CRITERIA AHA 2015 IN DETECTING ACUTE RHEUMATIC FEVER CASES"** is thebonafide work of **Dr. K.MURUGALAKSHMI @ CHITRA** in partial fulfilment of theuniversity regulations of the Tamil Nadu Dr. M.G.R Medical University, Chennai for **M.D Degree Branch VII – PAEDIATRIC MEDICINE** examinationto be held in April 2019.

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DECLARATION

I, **Dr. K.MURUGALAKSHMI @ CHITRA**, solemnly declare that the dissertation titled **"STUDY ON EFFECTIVENESS OF REVISED JONES CRITERIA AHA 2015 IN DETECTING ACUTE RHEUMATIC FEVER CASES"** has been conducted by me at Institute of Child Health and Research Centre, Government Rajaji Hospital, Madurai under the guidance and supervision of Prof**. Dr. M. BALASUBRAMANIAN M.D DCH.**

This is submitted in part of fulfilment of the regulations for the award of M.D Degree Branch VII (Paediatric Medicine) for the April 2019 examination to be held under The Tamil Nadu Dr. M.G.R Medical University, Chennai. This has not been submitted previously by me for any Degree or Diploma from any other University.

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Date:

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CONTENTS

INTRODUCTION

Acute rheumatic fever is a non suppurative immune mediated reaction secondary toGroup A Beta haemolytic streptococcus (GABHS)throat Infection. Rheumatic heart disease is becoming a very rare disease in the developed world.However, rheumatic fever and rheumatic heart disease continues to be a major public health problem in many developing countries like India. The morbidity, mortality and economical losses due to rheumatic heart diseaseare troublesome in many parts of the country. The morbidity from a single episode of acute rheumatic fever is less severe and rarely it cause death. But the major problem is due to the long term complication of recurrent episodes. This leads to damage to heart valves and development of rheumatic heart disease. As per rheumatic heart disease global status report, around 30 million known to suffer from rheumatic heart disease which is mainly seen in developing countries causing 2,75,000 premature deaths/ year[1].As per recent studies done at Kerala and Chandigarh incidence of rheumatic fever in India varies from 0.42 per 1,000 to 11 per 1000 and the prevalence of rheumatic heart disease ranges from 0.56 per 1,000 populations to 11 per 1000.

The incidence and prevalence appears to be less in India. This may be attributable to the fact that certain manifestations which were very common in the past year such as carditis, subcutaneous nodule are less common nowadays [2]. Is it really a true decline? Studies regarding rheumatic heart disease

prevalence are very less in our country. Hence the decline has to be questioned.Because of the changes in the incidence of rheumatic fever in the past years, Jones criteria underwent many revisions over years**.** These revisions increased the sensitivity of diagnosing acute rheumatic fever.

Dr T Duckett Jones dedicated his career in study onAcute Rheumatic Fever (ARF). One of his main contributions was development of clinical criteria to diagnose acute rheumatic fever. This criterionis calledas “Jones Criteria”. But in the last 10 years there were many changes in Jones criteria to increase the sensitivity, specificity to diagnose Acute Rheumatic Fever, and the recent changes is published by American heart association (AHA) 2015.

A single set of diagnostic criteria for Acute Rheumatic Fever may leads to over diagnosis in low risk region and under diagnosis in high incidence region. To overcome these drawback Jones criteria was modified. Low risk and moderate/high risk population was defined and separate criteria was made for these two groups.

Theidea of re-evaluating the diagnosis of Acute Rheumatic Fever in various populations isdone by Australia and New Zealand. They have released a separate diagnostic guidelines.[3,4] using echocardiographic technique to identify SUBCLINICAL CARDITIS.[5,6,7]- diagnosis of carditis using echo even in the absence of clinical carditis. In their guidelines, Subclinical carditis is included as major criteria. Based on this American heart association (AHA) formed a

revised guideline in the year 2015 to diagnose Rheumatic Fever in moderate/high risk group. There is no study conducted in Tamilnadu to compare revised Jones 2015 with old Jones criteria. So we have compared the diagnostic yield of acute rheumatic fever by revised Jones 2015 guidelines over old Jones criteria in people attended or admitted in paediatric ward at Institute of child health and research centre, Government Rajaji hospital, Madurai.

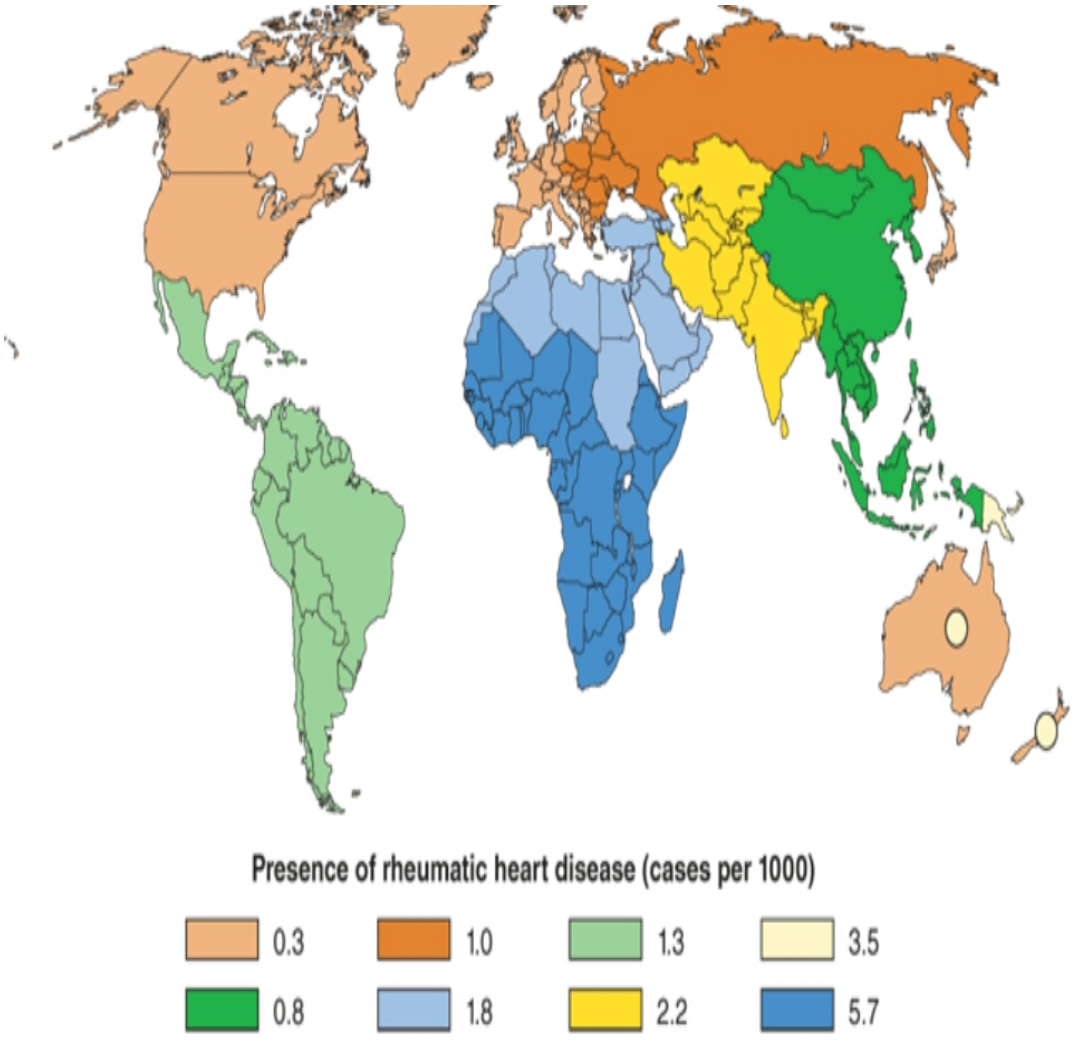


Figure 1:showing prevalence of Rheumatic heart disease worldwide.

REVIEW OF LITERATURE:

HISTORY OF JONES CRITERIA:

In the year of 1898 in London, William Cheadle described rheumatic fever with features consists of carditis, subcutaneous nodules,erythema marginatum and polyarthritis[8]. Aschoff in the year 1904 came up with the pathologic lesion which is characteristic of rheumatic fever known as ASCHOFF bodies[9]. It was T. DUCKETT JONES who described major and minor criteria to diagnose acute rheumatic fever in the year 1944[10].

The Original Jones Criteria (1944)

Major Criteria	Minor Criteria
Carditis	Fever
Arthralgia	Abdominal pain
Chorea	Precordial pain
Subcutaneous nodules	Erythema marginatum
History of previous definite rheumatic fever or rheumatic heart disease	Epistaxis
	Pulmonary findings
	Laboratory findings
	ECG abnormalities
	Microcytic anemia
	Elevated WBC
	Elevated ESR

The presence of two major or one major and two minor manifestations indicates a high probability of acute rheumatic fever.

Figure 2: showing the original Jones criteria proposed in 1944

Later, this criterion was modified by American Heart Association in the year 1992[10]. For the past 23 years, modified 1992 JONES criteria were extensively used.

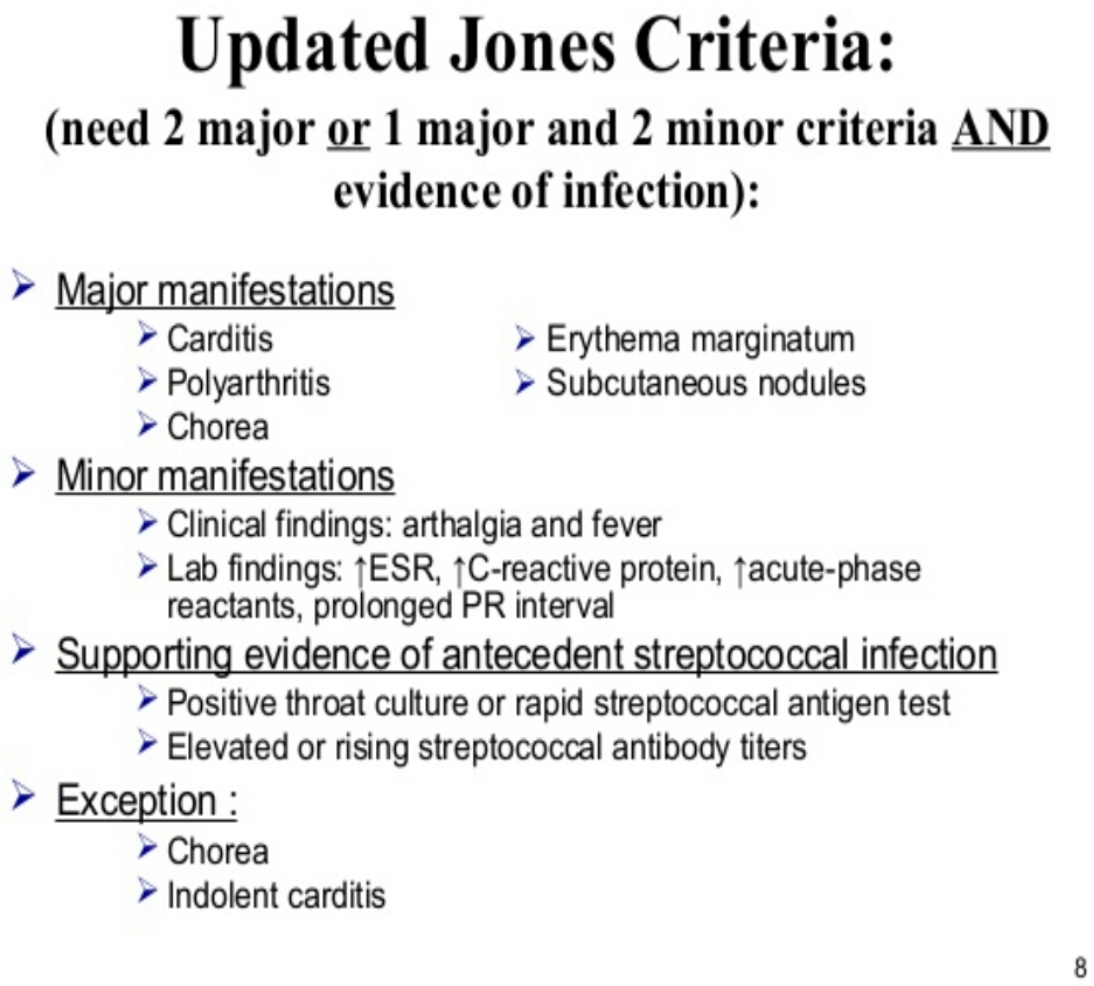


Figure 3: showing modified Jones criteria 1992

Due to improvements in standard of living in developed countries there has been marked decline in occurrence of rheumatic fever incidence in 20th century. This is due to life style modification such as living hygiene, health, literacy particularly in females, medical facilities and invention of penicillin to treat

streptococcal infection. The incidence and the prevalence aredifferent between developed and developing countries. Hence a single set of criteria will not be helpful. Hence American Heart Association (AHA) has modified JONES criteria in the year 2015 to diagnose between low risk and moderate/high risk populations. World health organisation (WHO) labelled 1984-85 as the year of "RHEUMATIC CHILD".

Several studies showed rheumatic fever is followed by Group A streptococcal throat infection. Epidemics are usually seen with rheumatogenic strains of streptococcus. Rheumatic fever recurrence is very well prevented by the use of antibiotics. Most common strains causing rheumatic fever are serotypes 1,3, 5,6,18 and 29. The incidence is more in the age group of 5-15 years and the incidence is rare before 3 years of age. The peak incidence is seen at the age of 8 years. The incidence of arthritis is more in adolescents and the incidence of carditis is more at 5 years of age. Both sexes are equally affected, but mitral stenosis and chorea are more common in females, while mitral regurgitation and aortic regurgitation are more common in males. The incidence is more common in spring and winter seasons. It isseen more commonly seen in low socio economic populations due to poverty, poor health, overcrowding.

PATHOGENESIS OF ACUTE RHEUMATIC FEVER

Any disease pathogenesis includes the agent factor, host factor and environment factor which lead to the development of disease.

AGENT FACTOR:

The Causative organism is group A Streptococcus also known as streptococcus pyogenes. These are gram positive cocci grown in chains. These are classified based on their ability to haemolyse the mammalian red blood cells.Beta haemolysis refers to the zone of complete haemolysis around colonies growing on blood agar. Based upon the Lancefield C carbohydrates, Streptococci are grouped from A to V. M protein of the organism determines the virulence of the organism by resisting phagocytosis. Based on the M protein antigen there are 220 serotypes have been identified and studied. M protein is encoded by emm gene. By using polymerase chain reactions, emm typing is used to isolate Streptococcus, thereby isolating more than 220 different M types.

GroupA Streptococcal pharyngitis is caused by types 1,12,28,4,3 and 2. Skin serotypes known to cause glomerulonephritis are 49, 55, 57 and 60 (nephrogenic).Rheumatic fever is a serious non suppurative complication of the organism. Rheumatogenic strains being M Types 1, 3,5,6,18,29[11]. It is know that these are pharyngeal strains, no skin strains are known to cause acute rheumatic fever[12].

Figure 4:showing gram stain picture of streptococci which occurs in chains

Group A Streptococcal pharyngitis typically affects school age children 5-15 years old occurring more during winter and spring. Symptoms includes rapid onset of fever and significant sore throat with red swollen tonsillitis often having a white exudate with enlarged tender cervical nodes.

Figure 5:showing Group A beta haemolytic streptococcal pharyngotonsillitis.

Scoring system to diagnose Group A Streptococcal pharyngitis was given by **McIssac**[13].

Criteria includes

1. History of temperature of >38*c
2. Absence of cough
3. Tender anterior cervical adenopathy.
4. Tonsillar swelling or exudate
5. Age 3-14 years

Each criterion carries one point. If age >45years, it subtracts one point. If the score is >4,likelihood of GAS Pharyngitis is high (70%). It needs to be confirmed by laboratory testing. Either throat culture or rapid streptococcal

antigen detection tests are used. Throat culture is the gold standard one.We can also use nuclei acid testing which is highly specific. Streptococcal rapid antigen detection tests (RADTs) are highly specific but less sensitive. It detects the group A carbohydrate of streptococcus, When RADT is positive, throat culture is not necessary. When RADT is negative,it should be confirmed by negative throat culture. Streptococcal antibody titre test are not useful in detecting acute pharyngitis [14].

Why diagnosing Group A Streptococcal pharyngitis is important, because it needs antibiotic treatment. The correct treatment of Group A Streptococcus pharyngitis with antibiotic will prevent the occurrence of acute rheumatic fever and its sequelae, chronic valvular rheumatic heart disease. It is highly effective when antibiotic therapy initiated within 9 days of onset of symptoms. It is highly susceptible to penicillin group of drugs. Hence treatment of GAS pharyngitis includes oral penicillin V or amoxicillin for the duration of 10 days is necessary. If compliance is a problem, single intramuscular injection of benzathine penicillin G is effective as well. Penicillin allergic patients can be treated with cephalexin, clarithromycin, clindamycin for 10 days or 5 days course of azithromycin. Tetracyclines,sulphonamides, fluoroquinolones should not be used to treat GAS pharyngitis.

Various theories have been proposed which includes cytotoxicity theory, immunologic theory.

Cytotoxicity theory: Direct cytotoxic effect of mammalian cardiac cells by GAS producing enzymes especially anti-streptolysin O is proposed. But this theory fails to explain the latency period of Group A Streptococcus pharyngitis and rheumatic fever onset.

Immunologic theory: Most widely accepted theory. This theory explains the latent period as well. There appears to be molecular mimicry between GAS components and mammalian tissues [15]. M protein which is presented in the cell wall bacteria shares some epitomes with cardiac muscle enzyme and sacrolemmal protein. Immunity produced against this M protein cross reacts with cardiac muscle protein causes valve, muscle, pericardial damage.

Yet another recently proposed hypothesis highlights antibody response to collagen occurs after binding of M Protein N terminus to collagen type IV, leading to inflammation of sub-endothelial areas like cardiac valves and myocardium.

HOST FACTOR:

No known predisposing factor was identified in detail .But the one who express HLA class II alleles are found to be susceptible hosts for rheumatic fever [16].

There are only very few studies regarding genetic susceptibility to acute rheumatic fever.

ENVIRONMENTAL FACTOR:

There appears to be well known association between low socioeconomic status, overcrowding and occurrence of acute rheumatic fever [17]. This is evident by the fact that the decreasing incidence of acute rheumatic fever in industrialised countries where the standard of living has been improved and there is less chance for overcrowding, poverty, poor hygiene and lack of medical facilities.

CLINICAL FEATURES OF ACUTE RHEUMATIC FEVER

After a latent period of 2 to 3 weeks of Group A Beta-Haemolytic streptococcal (GABHS) pharyngitis, symptoms of acute rheumatic fever develops. Not all GABHS leads to acute rheumatic fever,the attack rate ranges from 0.3 to3% [18]. Manifestations include joint involvement, cardiac involvement, CNS involvement, skin and subcutaneous tissue.Among these, joint involvement is very common constituting about 75%, followed by cardiac involvement which is about 50% to 60%.

There are 5 major criteria which includearthritis,carditis,chorea,subcutaneous nodules and erythema marginatum.

ARTHRITIS:

Arthritis in acute rheumatic fever typically involves larger joints like knee,ankles,wrists and elbow showing typical migratory pattern. Migratory refers to the involvement of joints sequentially,i.e.,the inflammation starts in the next joint with complete resolution of inflammation in the previously inflamed joints without any deformity. Involvement of shoulder joints,hip joints,small joints of hand and feet are less common. Another characteristic feature is response to salicylate therapy. If there is no response to salicylate, an alternate diagnosis is to be considered.

It needs to be differentiated from juvenile rheumatoid arthritis. Main differentiating feature is the indolent course, symmetrical involvement of peripheral small joints with morning stiffness with ASO titre negativity and absence of prompt response to salicylates in case of rheumatoid arthritis

CARDITIS:

Carditis is considered as serious manifestation of acute rheumatic fever. In rheumatic fever involvement of all three layers of heart may occur that is called as **PANCARDITIS**. Involvement of endocardium (valvulitis) is a universal finding presenting as murmur or an echo evidence of valvulitis. Involvement of pericardium is made out by either as pericardial friction rub or pericardial effusion. Rheumatic pericarditis never causes cardiac tamponade.

Myocarditis manifests as tachycardia, cardiomegaly or congestive cardiac failure. In case of isolated myocarditis without endocarditis, rheumatic aetiology is unlikely. **ASCHOFF BODIES** is a characteristic pathological lesion found in rheumatic myocarditis.

Figure 6:showing histopathology finding of acute rheumatic fever (aschoff's body)

Symptoms and signs include chest pain, palpitations due to tachycardia, features of congestive heart failure like exertional dyspnoea, tachycardia, gallop rhythm, swelling of legs, decreased urine output. Carditis can further be classified as mild, moderate and severe. Mild cardiomegaly is defined as

moderate carditis. Marked cardiomegaly with congestive cardiac failure is considered as severe carditis. Classification of carditis is necessary for the treatment aspect both in bed rest and use of anti-inflammatory agents.

Most common valve to be involved in acute rheumatic fever is mitral valve,presenting as valvular insufficiency (mitral regurgitation) with a holosystolic murmur radiating to axilla. Next most common valve is aortic valve. Stenotic lesions are less common during early stage. Stenotic lesions of valves occur years after first episode, often occur after recurrent episodes with progressive valvular disease.

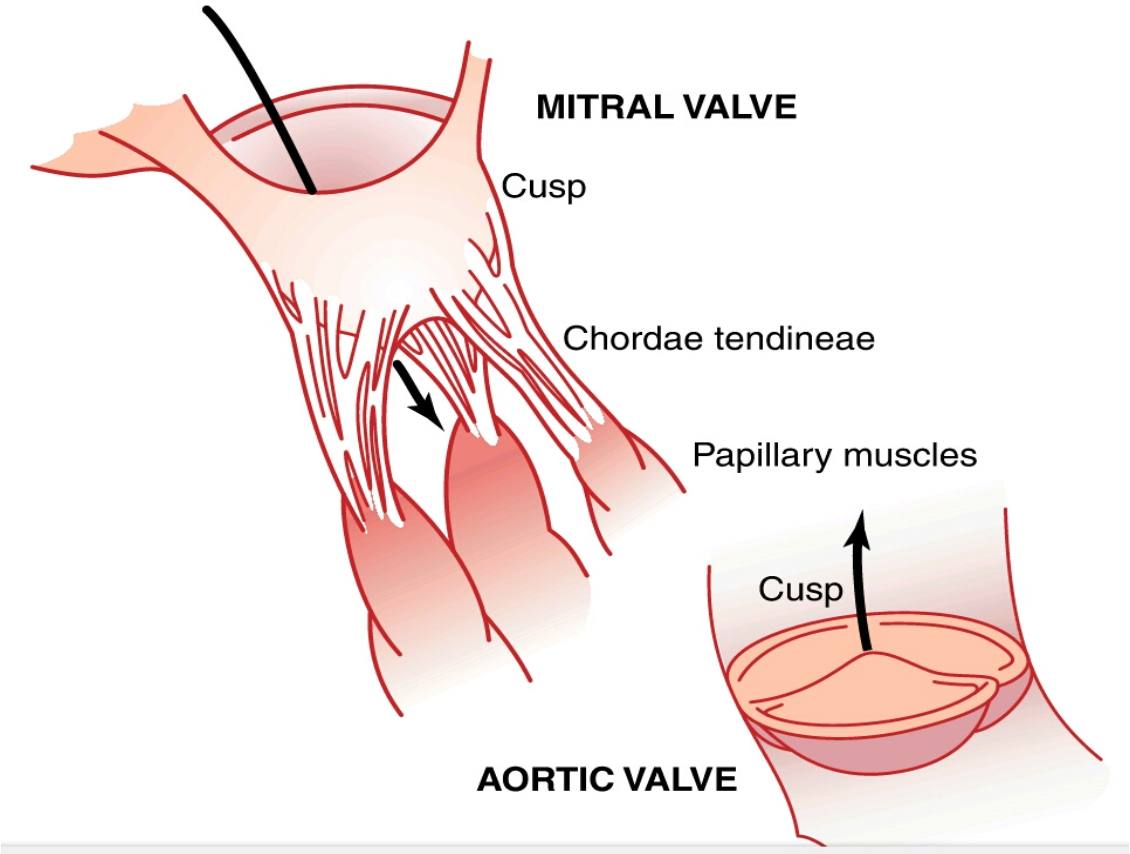


Figure 7: showing anatomy of Mitral valve and Aortic valve.

It has to be differentiated from viral myocarditis, pericarditis,Kawasaki disease and infective endocarditis. It will be differentiated by blood cultures and vegetation's seen on echocardiogram.

CHOREA (SYNDENHAM'S CHOREA):

Chorea (Sydenham's chorea) occurs in 10 to 15 % in acute rheumatic fever.It is also known as St. Vitus dance. Manifestations of chorea vary from emotional liability,poor school performance to involuntary semi purposeful movements, which is increased during stress and resolves with sleep. It may manifests as an isolated symptom, mostly affecting females. Milkmaid grip sign, pronator sign, darting movements of tongue, poor handwriting are the signs present in patients presenting with chorea.

Due to long latent period (months), acute phase reactants and antibody titres will be normal. It resolves by 8 to 15 weeks, may persist till 2 years, but rarely leads to permanent neurological sequelae. Patients with chorea also need secondary prophylaxis with penicillin [19].It needs to be differentiated from Wilson's disease, systemic lupus erythematosus, Huntington chorea.

ERYTHEMA MARGINATUM:

Erythema marginatum occurs in about 1% in rheumatic fever. It is described as erythematous evanescent rash having irregular serpiginous margins which is non-pruritic, occurs more over the trunk and extremities sparing the face. Rash is prominent on warming the skin.

Figure 8:showing erythema marginatum.

SUBCUTANEOUS NODULES:

Subcutaneous nodules are also a less common presentation like erythema marginatum (1%)[20]. There is a known correlation between subcutaneous nodules and carditis. These are firm,non-tender,size varying from 0.5 to 2cm movable under bony prominences along the extensor surface over occipital, elbows, ankles,knees and Achilles tendon.

Figure 9:showing subcutaneous nodule

MINOR CRITERIA:

Minor manifestations include fever,arthralgia, acute phase reactants like ESR and CRP, electrocardiographic changes like PR interval prolongation.

Fever is defined as having temperature more than 38*c in high risk population and at least 38.5*c in low risk population.

ESR and CRP elevation occurring in acute rheumatic fever are taken into minor criteria. In high risk populations, it is defined as ESR at least 30mm/hr and CRP >3mg/dl. In low risk group,it is defined as ESR of at least 60mm/hr is necessary to consider being positive. There is no change for CRP.

PR prolongation in ECG is neither specific nor indicative of active carditis.

Other minor clinical manifestations include Polyarthralgia in low risk populations.After 2015 revised Jones criteria, monoarthralgiais also considered as minor criteria in high risk population group. Other features include malaise, increased sleeping pulse rate,anaemia etc.

ESSENTIAL CRITERIA:

To diagnose acute rheumatic yet other important criteria is supporting evidence of previous streptococcal infection. This can be identified by positive throat culture, rapid streptococcal antigen test and elevated or rising streptococcal antibody titre.

Since there is a latent period between streptococcal throat infection and acute rheumatic fever,demonstration of organism in throat swab culture is less, only 10-20% will be positive. This is also true for rapid streptococcal antigen test because of the latent period,mostly it will be negative.

Hence evidence relies on antibody titre elevation which includes [21, 22]

1. Anti streptolysin O (ASO)

2. Anti-deoxyribonuclease B (anti-DNase B)

3. Antihyaluronidase

ASO titre elevation of at least 333 Todd units is considered positive in children and those 200 Todd units is considered as positive in adults. If the ASO titre is low,it does not rule out rheumatic fever. Need to repeat the titre for positivity.

If single antibody measurement is done (usually ASO titre),it shows evidence in only 80 to 85%. But if three antibody titres (anti streptolysin O,

Anti-deoxyribonucleaseB(anti-DNase B), Antihyaluronidase)are measured,detection rate may increase up to 95-100%.

In patients with manifestation of chorea which occurs after long period,antibody titres may lie in the normal range. For other manifestations, antibody titre and clinical manifestation often coincides well.

DIAGNOSIS OF ACUTE RHEUMATIC FEVER:

Since there is no single clinical or laboratory evidence which is pathognomic of the disease, hence 1944 T. DUCKETT JONES defined one criterion to diagnose rheumatic fever.

It consists of 5 major criteria includes migratory polyarthritis,carditis,chorea,subcutaneous nodules and erythema marginatum. Minor criteria include fever,arthralgia,elevated ESR, elevated CRP, prolonged PR interval. A final important criterion is an essential criterion which includes the evidence of precedingstreptococcal infection.

In the presence of preceding streptococcal infection, 2 MAJOR criteria or 1 MAJOR and 2 MINOR criteria are necessary to diagnose rheumatic fever. This is applicable to diagnose recurrence of rheumatic fever also.

WHAT IS NEW IN REVISED JONES CRITERIA 2015:[21,23]

Single diagnostic criteria cannot be applicable to all countries since the prevalence of the disease varies from developing countries to developed countries. Hence it may cause over diagnosis in low risk populations and under diagnosis in high risk populations. 2015 revised Jones describes different criteria to be followed in high risk and low risk population.

HIGH RISK POPULATION is defined as

INCIDENCE OF ACUTE RHEUMATIC FEVER > 2 per 100,000 (one lakh) school age children/ year.

OR

ALL AGE RHEUMATIC HEART DISEASE PREVALENCE > 1 per 1000 population.

This includes all of US,Canada and Western Europe.

LOW RISK POPULATION is defined as

INCIDENCE OF ACUTE RHEUMATIC FEVER < 2 per 100,000 (one lakh) school age children/ year.

OR

ALL AGE RHEUMATIC HEART DISEASE PREVALENCE < 1 per 1000 population. This includes Maoris in New Zealand, aborigines in Australia, Pacific Islanders, most developing countries.

MAJOR CRITERIA REVISION INCLUDES:

CHANGE 1:

Apart from clinically detectable carditis, it includes sub clinical carditis as major criteria in high risk populations.

Subclinical carditis is defined as in the absence of murmur the echocardiographic evidence of valvulitis meeting specific criteria to distinguish physiologic from pathologic.

CHANGE 2:

Apart from polyarthritis as major criteria,Polyarthralgia and mono arthritis is considered as major criteria in moderate/ high risk population.

Table 2 A Comparison of past and current recommendations for evaluation of carditis in suspected and confirmed acute rheumatic fever (ARF)

	Clinical carditis as a MAJOR manifestation	Preform echo in all confirmed cases of ARF	Perform echo in all suspected cases of ARF	Subclinical carditis as a MAJOR manifestation
Jones 1992[7]	Yes	No	No	No
WHO 2001[14]	Yes	No	No	No
New Zealand 2008[13]	Yes	Yes	Yes	Yes; all populations
India 2008[15]	Yes	Yes	No	No
Australia 2012[11]	Yes	Yes	Yes	Yes; high-risk populations
Jones 2015[17]	Yes; unless disproven by echo	Yes	Yes	Yes; all populations

MINOR CRITERIA REVISION INCLUDES :

CHANGE 3:

Monoarthralgia is considered as minor criteria in high /moderate risk population.

CHANGE 4:

Fever > 38*c in high risk populations, whereas fever > 38.5 *c in low risk populations.

CHANGE 5:

ESR>30 mm/hr in high risk population, whereas ESR >60 mm/ hr in high risk populations.

CHANGE 6:

Another revision in high risk populations includes for diagnosing recurrence of acute rheumatic fever PRESENCE OF 3 MINOR CRITERIA WITH EVIDENCE OF PRECEDING STREPTOCOCCAL INFECTION is enough.

In three circumstances, strict adherence to JONES criteria is not needed, which includes

1. Chorea being a only major manifestation
2. Indolent carditis

3. Recurrence of acute rheumatic fever in patients living in high endemic areas.

Jones criteria for the diagnosis of ARF

	Low-risk population ARF incidence ≤2 per 100 000 school-aged children or all-age RHD prevalence of ≤1 per 1000 population year	**Moderate/high-risk population** Children not clearly from a low-risk population
Major criteria		
Carditis	Clinical and/or **subclinical***	Clinical and/or **subclinical***
Arthritis	Polyarthritis	**Monoarthritis,** polyarthritis and/or **polyarthralgia**
	Chorea	Chorea
	Erythema marginatum	Erythema marginatum
	Subcutaneous nodules	Subcutaneous nodules
Minor criteria		
Carditis	Prolonged PR interval†	Prolonged PR interval†
Arthralgia	Polyarthralgia	**Monoarthralgia**
Fever	≥38.5°C	**≥38°C**
Markers of inflammation	Peak ESR ≥60 mm in 1 h and/or CRP ≥3.0 mg/dL	Peak **ESR ≥30 mm** in 1 h and/or CRP ≥3.0 mg/dL

Changes compared with the 1992 revision[7] are highlighted in **bold**.
*Subclinical carditis: Seen only on echocardiography without ausculatory findings.
†Accounting for age variability and only if carditis NOT counted as a major criteria.
ARF, acute rheumatic fever; CRP, C reactive protein; ESR, erythrocyte sedimentation rate; RHD, rheumatic heart disease.

Figure 10: showing revised Jones criteria 2015

ECHOCARDIOGRAPHY AS A DIAGNOSTIC TOOL:[21,24]

Sub clinical carditis is the presence of valvulitis by echo evidence in the absence of clinically detectable murmur.

DOPPLER ECHO CRITERIA:[21,24]

PATHOLOGIC MITRAL REGURGITATION (ALL 4 MET)	PATHOLOGIC AORTIC REGURGITATION (ALL 4 MET)
1. Seen in at least 2 views	1. Seen in at least 2 views
2. Jet length ≥2 cm in at least 1 view	2. Jet length ≥1 cm in at least 1 view
3. Peak velocity >3 meters/ second	3. Peak velocity >3 meters/ second
4. Pan-systolic jet in at least 1 envelope	4. Pan-diastolic jet in at least 1 envelope

Figure 11: showing ECHO DOPPLER CRITERIA for subclinical carditis by AHA/ACC 2015

DOPPLER MORPHOLOGICAL CRITERIA:[21,24]

Echocardiographic (morphological) criteria:

- In acute mitral valve involvement:
  1. Dilatation of mitral annulus.
  2. Elongation of chordae tendineae.
  3. Rupture of chorda tendinea with acute mitral regurgitation.
  4. Prolapse of anterior (less often posterior) leaflet.
  5. Nodular lesions on leaflets.
- In chronic mitral valve involvement (invisible in acute involvement):
  1. Thickening of leaflets.
  2. Thickening of chordae tendinea, with their fusion.
  3. Limited mobility of leaflets.
  4. Calcifications.
- Lesions in acute and chronic aortic valve involvement:
  1. Symmetrical or focal thickening of leaflets.
  2. Disturbed leaflet coaptation (leaflet closing during systole).
  3. Limited mobility of leaflets.
  4. Prolapse of leaflets.

Figure 12: showing ECHO morphological criteria in diagnosing ARF and RHD

This shows the importance of echocardiographic examination in detecting rheumatic valvulitis in suspected cases even in the absence of clinical evidence .of carditis.

CLINICAL COURSE AND PROGNOSIS:

Of all these clinical features, arthritis resolves completely without causing permanent damage to the joints. Even chorea also resolves without causing permanent neurological sequelae. Only carditis will leave a scar in the heart valves. But in patients with first episode with mild carditis, 50% cases resolves with no residual heart disease with appropriate treatment. If the initial episode cardiac involvement is severe, damage to the heart is also severe leading to residual heart disease. Hence,Rheumatic fever is known by the fact that it LICKS THE JOINT, BUT BITES THE HEART by Laseque in the year 1884.

Figure 1 | Schematic images of the MV in systole. **a** | A normal MV. **b** | RHD with excessive leaflet tip motion, which results in abnormal coaptation and regurgitation, but usually does not meet the echocardiographic definition of 'MV prolapse'. **c** | Echocardiographic MV prolapse, defined by >2 mm billowing of the leaflet tissue into the left atrium. In echocardiographic MV prolapse (**c**), coaptation of leaflets often remains normal, as the free edges of the leaflet stay in apposition below the plane of the MV annulus. Abbreviation: AMVL, anterior MV leaflet; MV, mitral valve; PMVL, posterior

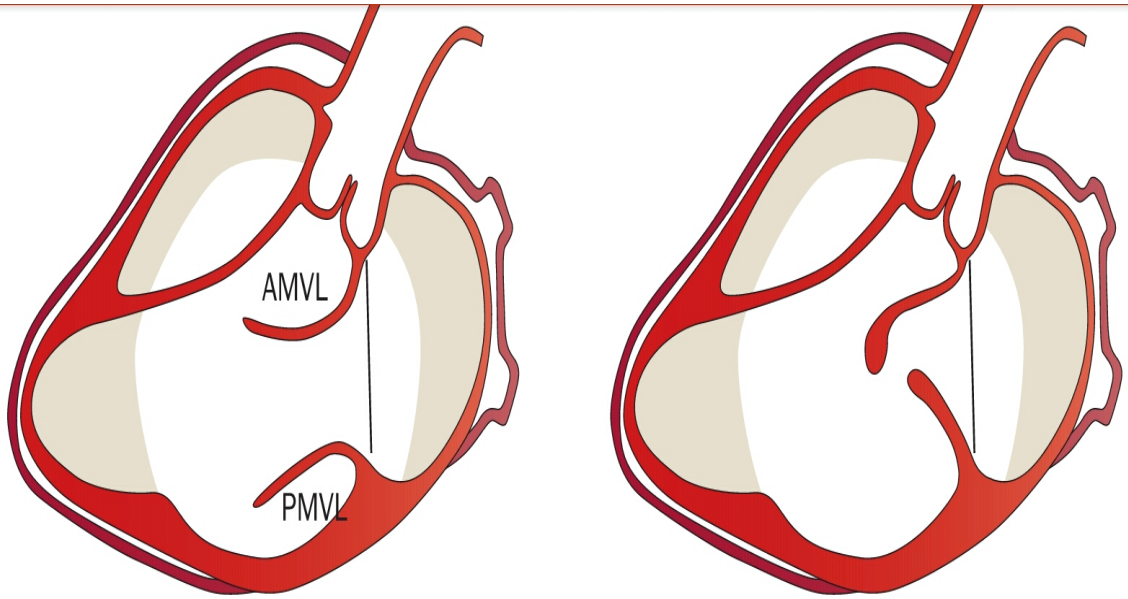


Figure 2 | Schematic images of the MV in diastole. **a** | A normal MV. **b** | A rheumatic MV with thickened and restricted anterior and posterior leaflets. Abbreviations:

TREATMENT OF ACUTE RHEUMATIC FEVER:

This includes 1. Eradication of the organism.

2. Suppression of inflammation.

3. Supportive therapy

4. Initiation of secondary prophylaxis.

ERADICATION OF ORGANISM

It is done by giving antibiotic therapy. Patient diagnosed as acute rheumatic fever should receive 10days of oral penicillin or amoxicillin [18].

Alternative to oral therapy is single intramuscular injection of Benzathine penicillin.

If the patient is allergic to penicillin,alternative drug of choice would be erythromycin for 10 days or with Clindamycin or with 5 days course of azithromycin [23]. These antibiotics will efficiently eradicate Streptococcal organism from the pharynx.

SUPPRESSION OF INFLAMMATION

Next line of management is to suppress the inflammation,thereby reducing the ill effects. This is achieved by the use of anti-inflammatory agents like salicylates and corticosteroids.

In patients with migratory polyarthritis and with carditis without failure, salicylates (Aspirin) can beused in the dose of 50-70mg/kg/day in 4 divided doses for 3 to 5 days. This will be followed by 50mg/kg/day for 3 weeks and 25mg/kg/day for another 3 to 4 weeks.

In persons where atypical form of acute rheumatic fever present, withholding salicylates will be helpful in determining the migratory nature of the disease.in that situation, paracetamol will be useful in reducing pain and fever. Because a single dose of aspirin can mask the migratory nature of arthritis, leading to difficulty in diagnosis.

Corticosteroids should be used as an anti-inflammatory drug in patients with severe carditis with massive cardiomegaly or with congestive cardiac failure. It is used in the dose of 2 mg/kg/ day in 4 divided doses for a period of 3 weeks. It should be followed by 1mg/kg/day of prednisolone for next 2 to 3 weeks. Tapering is suggested by the dose of 5mg/day every 2-3days. While tapering steroids, it is necessary to add aspirin in the dose of 50 mg/ kg/day in 4 divided doses for another 6 week. This is especially important to prevent the occurrence of REBOUND INFLAMMATION while steroid is being tapered.

SUPPORTIVE THERAPY:

Bed rest plays an important role in acute rheumatic fever. Duration of bed rest is prolonged when there is an active carditis. Avoidance of strenuous exercise is also important in patients with carditis. Duration of bed rest is determined based on individual patient and his underlying condition requirement. Ambulation can be initiated once the acute phase reactants come to normal.

Other management includes salt and fluid restriction, oxygen therapy,controlling heart failure using anti failure measures like diuretics,digoxin (used with caution).

MANAGEMENT OF CHOREA:

Management of chorea is different from that of arthritis and carditis, as it usually manifests after the inflammation part settles down. Hence use of anti-inflammatory drug is not indicated. Phenobarbital is the drug of choice in the dose of 15-32 mg orally either TDS or QID. Haloperidol or chlorpromazine is used when phenobarbital is ineffective. Dose of haloperidol is 0.01 to 0.03 mg/kg/day 2 divided doses.

INITIATION OF PROPHYLAXIS:

Treatment of acute rheumatic fever is cumbersome. But prevention is much easier than treatment. Any disease prevention includes primordial,primary,secondary and tertiary prevention.

PRIMORDIAL PREVENTION:

It is achieved by prevention of the disease by decreasing the exposure to risk factors. This is done by improving the standard of living, Avoidance of overcrowding, improving health facilities, improving education regarding acute RF. Improving socio economic status for the population at risk for developing rheumatic fever has shown decline in incidence and prevalence of the disease.

PRIMARY PROPHYLAXIS:

Identification of GAS pharyngitis from other viral pharyngitis and prompt treatment initiation within 9 days of onset of illness with appropriate antibiotic therapy for the appropriate duration of time is highly effective in preventing occurrence of rheumatic fever [17, 18]. If there is high clinical suspicion of GAS pharyngitis, tests to confirm GAS pharyngitis need to be undertaken. The major drawback to implement primary prophylaxis is that 30% patients do not seek medicalattention for pharyngitis. Another problem is that 30% patients develop rheumatic fever without preceding symptoms of GAS pharyngitis.

SECONDARY PROPHYLAXIS:

After the first attack of acute rheumatic fever, secondary prophylaxis with daily antibiotic therapy is initiated [23]. This is to prevent recurrence of GAS infection in an already damaged heart. This is true because, in patients with carditis in their first episode, the likelihood of recurrence in the upcoming 5 years is very high. When recurrence occurs, the damage to the heart valves is more. It will lead to chronic progressive valvular disease which increases both morbidity and mortality due to rheumatic heart disease.

DRUG	DOSE	ROUTE
Penicillin G benzathine	600,000 IU for children weighing ≤60 lb 1.2 million IU for children weighing >60 lb, every 4 wk*	Intramuscular
or		
Penicillin V	250 mg, twice a day	Oral
or		
Sulfadiazine or sulfisoxazole	0.5 g, once a day for patients weighing ≤60 lb 1.0 g, once a day for patients weighing >60 lb	Oral
FOR PEOPLE WHO ARE ALLERGIC TO PENICILLIN AND SULFONAMIDE DRUGS		
Macrolide or azalide	Variable	Oral

Figure 15: showing secondary prophylaxis for recurrence ARF

CATEGORY	DURATION
Rheumatic fever without carditis	5 yr or until 21 yr of age, whichever is longer
Rheumatic fever with carditis but without residual heart disease (no valvular disease*)	10 yr or until 21 yr of age, whichever is longer
Rheumatic fever with carditis and residual heart disease (persistent valvular disease*)	10 yr or until 40 yr of age, whichever is longer; sometimes lifelong prophylaxis

Figure 16:showing recommended secondary prophylaxis duration for rheumatic fever.

TERTIARY PREVENTION

This stage increases the cost of living only by increasing the duration of hospital stay. The need for valve replacement therapy and lifelong dependency on anticoagulant therapy is mandatory when the valvular lesions are not under control with pharmacologic therapy.

REVIEW OF LITERATURE:

Dinesh Kumar et al studied the comparison between revised Jones criteria 2015 and old criteria. The study was a retrospective study conducted in PGIMER in the year 2016. 93 cases of rheumatic fever were studied, out of 93 cases, 50 were diagnosed to have first episode, and the remaining 43 had recurrence. Mean age of occurrence was 11.3 years. In the first episode, while using old criteria only 66% were diagnosed as acute rheumatic fever, while using Revised Jones criteria diagnostic yield increased from 66% to 86%. There were no differences in the diagnosis in the recurrence group. Among the clinical manifestations , most common was carditis (54%)followed by arthritis (34%).In the various clinical presentations , sub clinical carditis contributes to 38% in detection rate i.e 19 of 50 patients in first episode had subclinical carditis . These 19 cases would be missed if we strictly adhere to old criteria (clinically evident carditis). Another revision in the 2015 criteria is inclusion of mono arthritis and Polyarthralgia as major criteria, mono arthritis contributes to 4% of cases, whereas Polyarthralgia contributes to 10% cases. Chorea was found to be

in 16% of cases. None of the patients had subcutaneous nodules and erythema marginatum.In their study, most common valve affected was mitral valve and mitral regurgitation being the most common lesion in their study. Mean ESR calculated from the study was 44mm/hr. They concluded the study with the fact that revised Jones criteria 2015 has increased the detection rate of acute rheumatic fever by the inclusion of subclinical carditis, Monoarthritis and Polyarthralgia. Subclinical carditis was the predominant clinical presentation in first episode, whereas carditis is the presentation in cases of recurrence.

Saxena et al (2013)conducted a cross sectional epidemiological survey in rural primary and secondary schools of Haryana and north India. Regarding echo being used as a screening tool for detecting rheumatic heart disease. Total of 6,270 children were screened using echo, clinically identified carditis was made out in 5 patients. But 128 cases were diagnosed using echocardiogram. This leads to the increase in prevalence of 0.8/1000 school children (clinical carditis) to 20.4/ 1000 population (subclinical carditis). This study supports the Echocardiogram importance in detecting subclinical carditis. The mean age of prevalence was found to be 10.78.

Ashwin reddy et al conducted a study in 50 children between age group of 5 to 16 years. Study was conducted to assess the sensitivity between clinical evaluation and echocardiographic evaluation in detecting rheumatic heart disease. Out of 50 cases, 37 cases were diagnosed by clinical evaluation, but 42

out of 50 were made out by echocardiography. Study also adds mitral valve is the most common valve to be involved (98%). Mitral regurgitation was the common lesion in 84% of cases both as an isolated lesion as well as with combination with other lesions. Mitral stenosis was noted in 50% of cases, it may be due to the upper limit of age group kept being 16 years.

Because in India, onset of juvenile Mitral stenosis was earlier because of high prevalence and frequent recurrent attacks. There was a significant statistical difference between clinical assessment and echocardiographic assessment of RHD.

Pelajo et al (2010) conducted a retrospective study on 536 children with diagnosis of rheumatic fever to evaluate the adherence to secondary prophylaxis and disease recurrence. 88 children had recurrence, common cause being not adherence to secondary prophylaxis. Non adherence to secondary prophylaxis was detected in 54.5% of patients, 31% of patients were not advised to take secondary prophylaxis because these patients were not diagnosed to have RHD due to lack of sufficient criteria. While on strict compliance on secondary prophylaxis, 14.5% patients had recurrences.

Satoshi sago et al (2017) conducted a retrospective study in paediatric population. 44 cases was diagnosed as acute rheumatic fever,with the mean age

of presentation was 8 years. Carditis was present in 27 cases out of 44 (61.4%), polyarthritis being second most common presentation (22cases (50%). Chorea was seen in 3 cases, subcutaneous nodules in 1 case and erythema marginatum was present in 7 cases. Median age of onset was 8.5 years.

METHODOLOGY

AIM AND OBJECTIVES:

To compare the diagnostic yield of 2015 revised Jones criteria with that of previous Jones criteria in detecting acute rheumatic fever in our population (high risk population).

PRIMARY OUTCOME:

To comparethe diagnostic yield of 2015 revised criteria with that of previous guidelines.

SECONDARY OUTCOME:

To find out the clinical characteristics presented in our study population.

STUDY DURATION:

Two years from September 2016 to august 2018.

STUDY DESIGN:

It was a cross-sectional observational study conducted at Institute of child health and research centre,Government Rajaji hospital,Madurai.

INCLUSION CRITERIA:

- Any Suspected Acute rheumatic fever cases in the age group of 5 -12 years.(H/o Fever,sore throat, arthralgia,arthritis, symptoms ofcardiac failure, Involuntary movements, skin lesions).
- Known case of rheumatic heart disease for recurrences.

EXCLUSION CRITERIA:

- Children with congenital heart disease and other acquired heart diseases like cardiomyopathies, Kawasaki disease.
- Juvenile rheumatoid arthritis and other connective tissue disorders were excluded.

MATERIALS AND METHODS:

- All cases of suspected rheumatic fever will undergo the following evaluation

- Detailed clinical history

  Proforma was used which includes the description of their complaints. Whether it was mono arthritis or polyarthritis. If poly arthritis whether it was migratory or non-migratory . H/o any joint pain was also included.

  Cardiac involvement was evaluated with any h/o chest pain, difficulty in breathing, any failure symptoms like decreased urine output,swelling of legs, orthopnoea, paroxysmal nocturnal dyspnoea.

  Skin lesions, skin swellings, involuntary movements were also looked for.

- Clinical examination

  Detailed cardiac examination was done in detecting murmur, failure features and cardiomegaly.

  Examination of Central nervous system was done for chorea. Detailed skin examination was also done in all cases. In cases with complaints of joint involvement, examination of joints was done to identify any swelling, tenderness.

  In order to prove our diagnosis, investigations were done on the study group with parents' consent.

INVESTIGATIONS:

- Complete haemogram
- ESR :
- CRP
- Chest X- ray
- ECG :
- Echocardiography :
- Evidence for streptococcal infection :
- 1. ASO titre –
- 2. throat swab culture
- ANA / RF - to R/o connective tissue disorder
- Peripheral smear – to r/o malignancy

All cases were examined and evaluated in detail in order to avoid misdiagnosis,at the same time not to miss a single case of acute rheumatic fever.

STASTISTICAL ANALYSIS:

Statistical analysis was done using percentages, mean values, standard deviation and p value. A p value of <0.05 was considered statistically significant.

RESULTS

Out of 60 cases of acute rheumatic fever and recurrence, 50were diagnosed as first episode and 10 with recurrence of rheumatic fever. Among 60 cases of rheumatic fever 36 (60%) are male and 24 (40%) are female. In our study the occurrence of disease is more among males than females.

1. SEX DISTRIBUTION AMONG STUDY GROUP

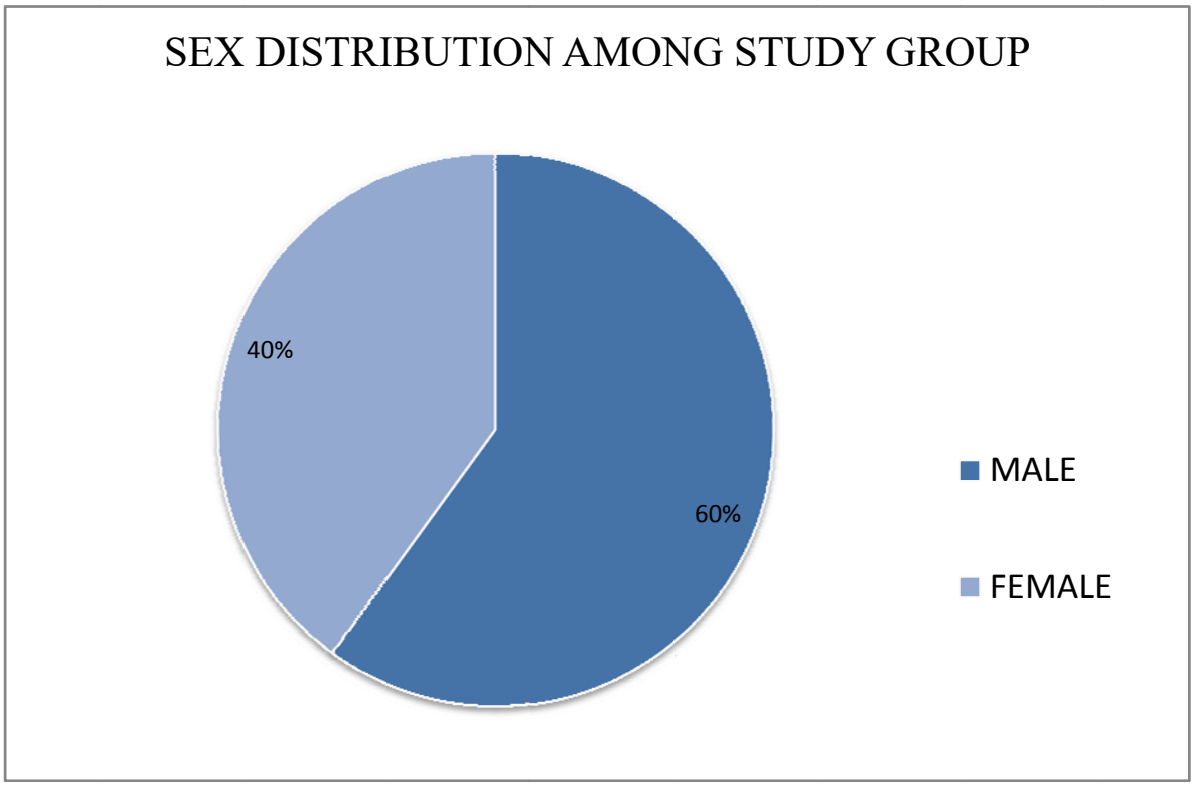


Chart 1:sex distribution among the study population

Above pie chart shows males are more affected than females.

Male affected – 36 (60%);

Female affected - 24 (40%)

SEX DISTRIBUTION	First episode of rheumatic fever Number (%)	Recurrence Number (%)	P value
MALE	29(58%)	7(70%)	0.4832
FEMALE	21(42%)	3(30%)	0.537

Table 1: sex distribution between first episode of rf and recurrent rf

29 male children presented with first episode ARF group, 7 male admitted with recurrent RF group.

21 female children presented with first episode ARF group, 3 female admitted with recurrent RF group.

In both the groups male children and female children were equally affected (P - 0.483; P – 0.537)

2. AGE DISTRIBUTION AMONG STUDY POPULATION

Among 60 patients,**Mean age** of distribution was**9.1** years (range 5-12 years) with **Standard deviation 1.699.**

22 (37%) cases were in 5- 8 yearsage group. 38 (63%) cases belong to 9 – 12 years age group distribution. No cases were diagnosed under 5 year's age group.

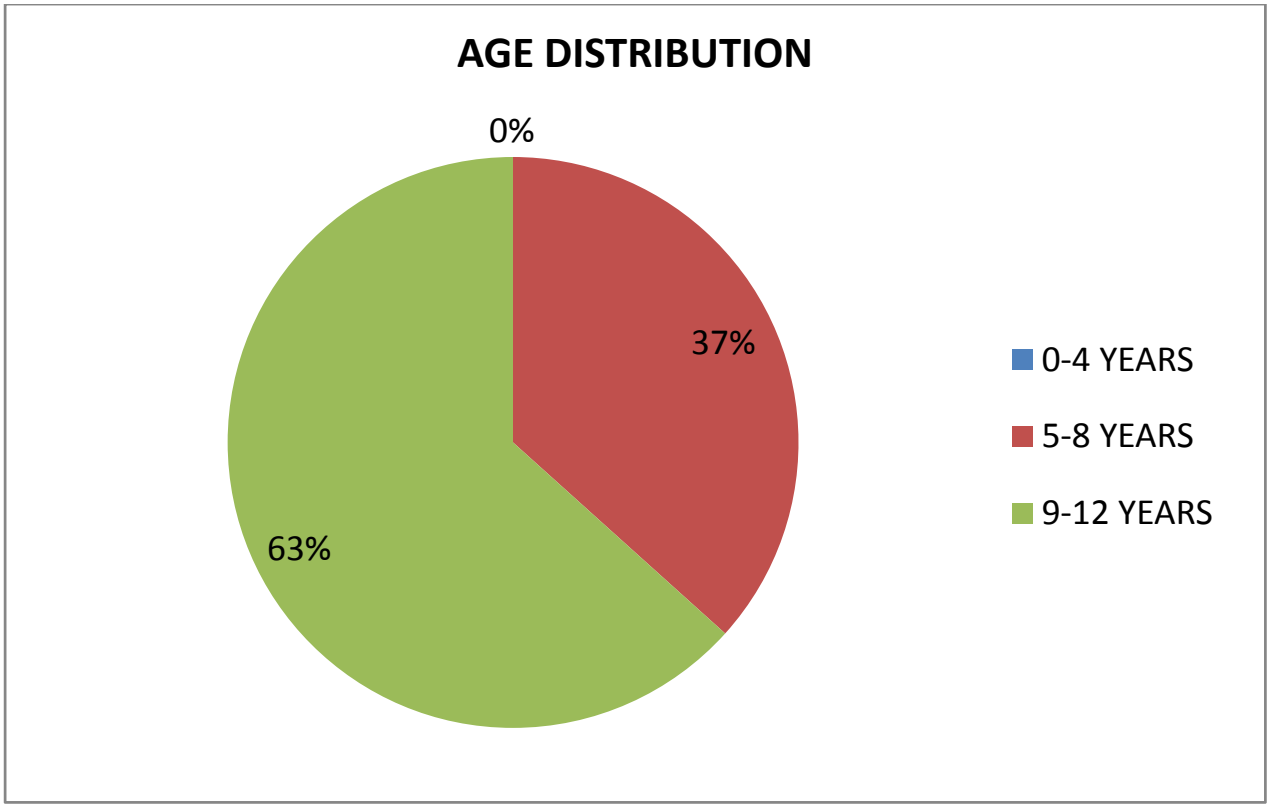


Chart 2: showing age distribution of the study population

AGE DISTRIBUTION	First episode Number (%)	Recurrence Number (%)	P value
0-4 YEARS	0	0	0
5-8 YEARS	20(40%)	2(20%)	0.2348
9-12 YEARS	30(60%)	8(80%)	0.0032

Table 2: showing age distribution between first episode and recurrence group.

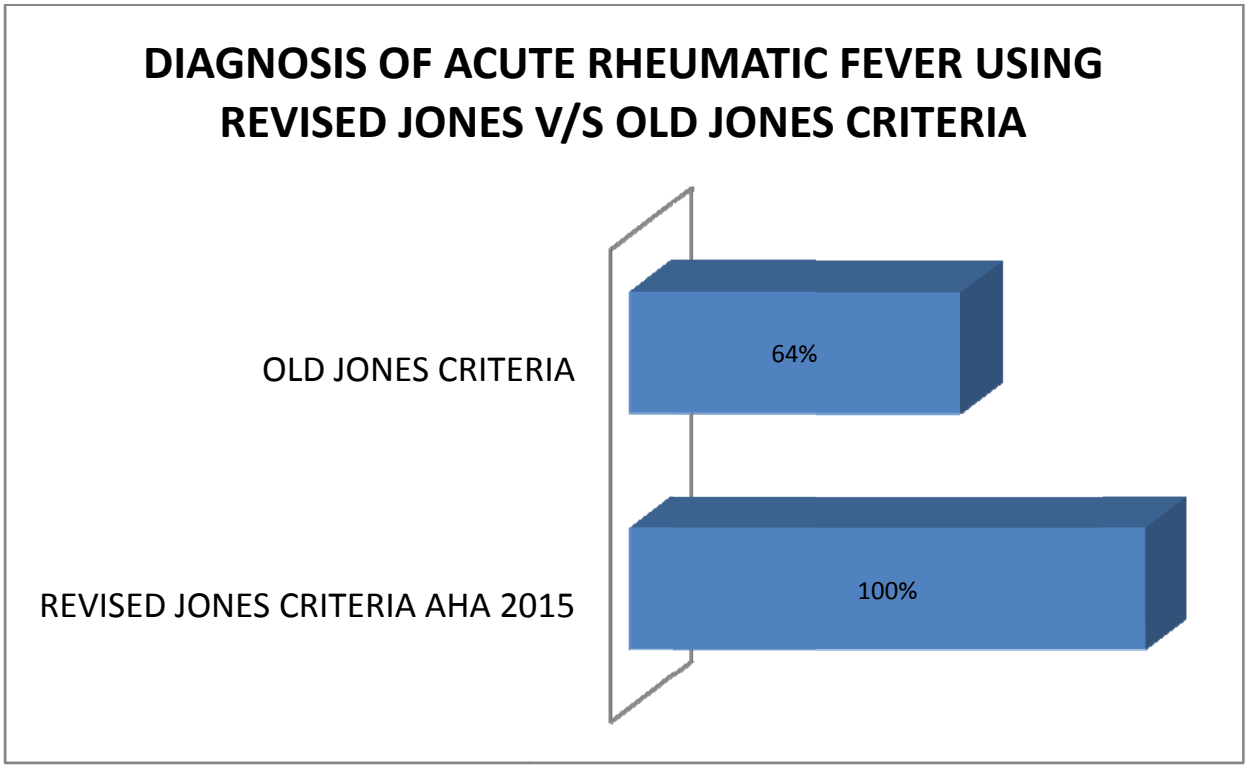
In both groups majority of cases presented in the age group of 9-12 years.

3.DIAGNOSIS OF ACUTE RHEUMATIC FEVER USING REVISED JONES CRITERIA VERSUS OLD JONES CRITERIA

Among the study group all 60 cases fulfilled the criteria of revised Jones criteria, only 38 cases fulfilled the criteria of old jones criteria.

Total no of cases fulfilled criteria of revised Jones criteria – 60 cases (100%)

Total no of cases fulfilled criteria of old Jones criteria – 38 cases (64%)



Bar chart 3:showing diagnosis of acute rheumatic fever using revised Jones v/s old Jones criteria.

DIAGNOSIS OF ACUTE RHEUMATIC FEVER	REVISED JONES CRITERIA AHA 2015 n (%)	OLD JONES CRITERIA n (%)	P value
	60 (100%)	38 (64%)	<0.0001

Table 3: showing diagnosis of acute rheumatic fever based on revised jones v/s old jones criteria

Comparing revised Jones criteria with old Jones criteria, 22 cases were newly diagnosed using revised Jones criteria, and it is statistically significant with the P value of <0.0001. From this we can conclude that REVISED JONES CRITERIA is superior in diagnosing ARF than old JONES CRITERIA.

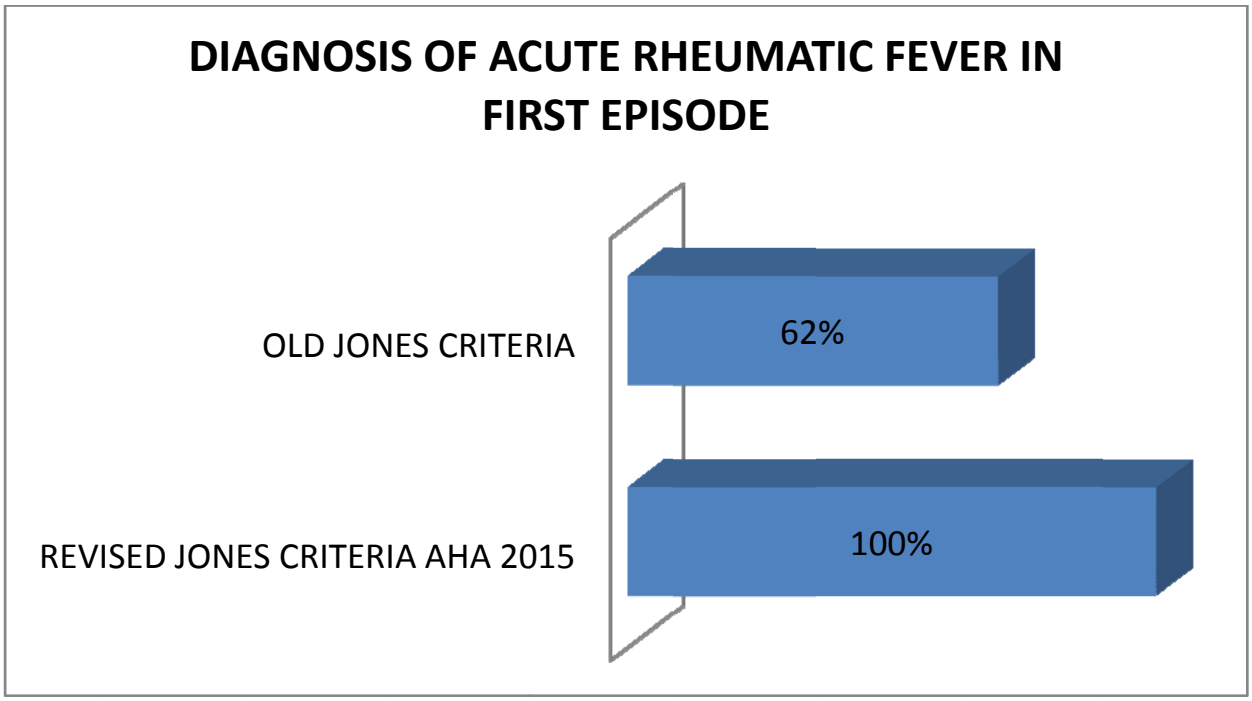
4. DIAGNOSIS OF ACUTE RHEUMATIC FEVER USING REVISED JONES CRITERIA VERSUS OLD JONES CRITERIA IN FIRST EPISODE GROUP

Further we evaluated the diagnostic yield of revised Jones in first episode group and recurrence group.

Total number of cases admitted with first episode – 50 cases

Number of patient diagnosed in first episode using Revised Jones criteria– 50 cases.

Number of patient diagnosed in first episode using old Jones criteria- 31 cases.



Bar chart 4: showing diagnosis of acute rheumatic fever using revised jones v/s old jones criteria in first episode.

DIAGNOSIS OF ACUTE RHEUMATIC FEVER(I episode)	REVISED JONES CRITERIA AHA 2015 n (%)	OLD JONES CRITERIA n (%)	P VALUE
	50 (100%)	31(62%)	0.0001.

Table 4: showing diagnosis of rheumatic fever in first episode group using revised jones versus old jones criteria.

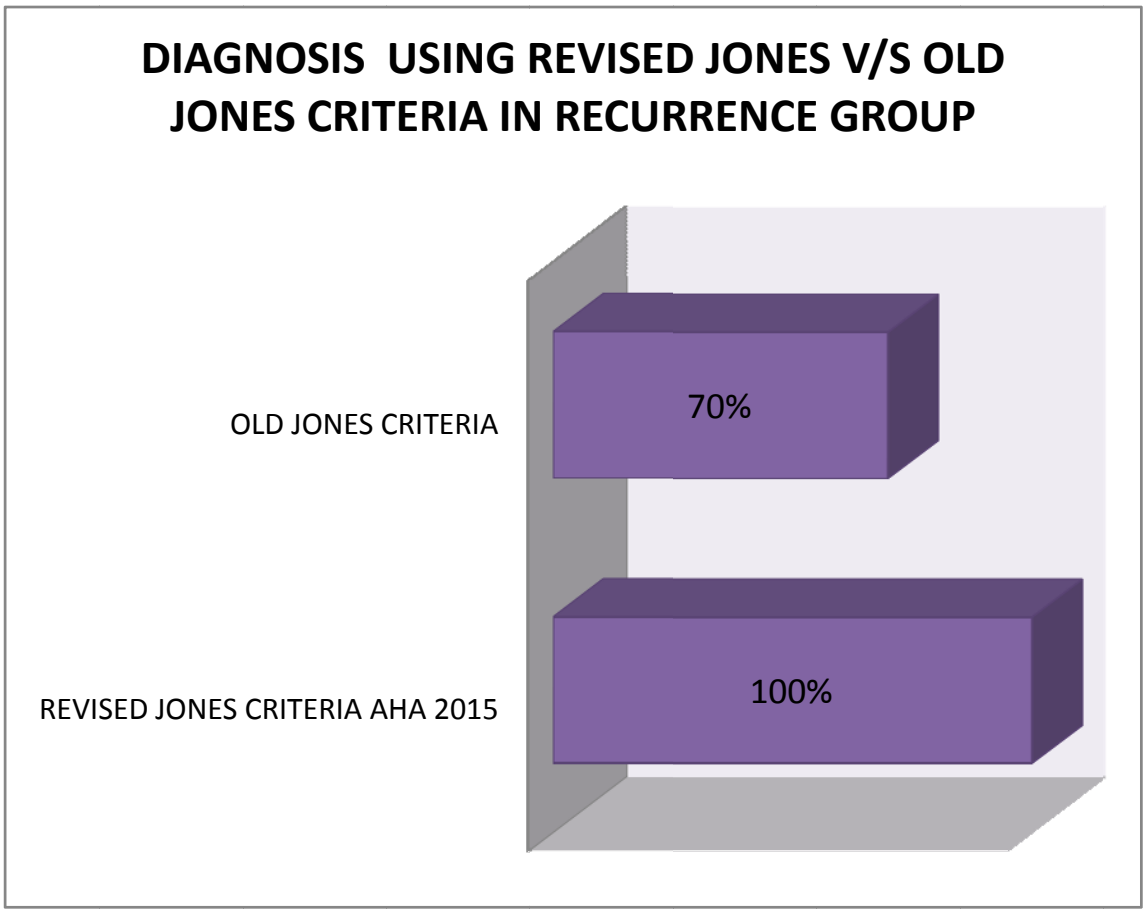
Above table clearly shows revised Jones criteria is superior in diagnosing acute rheumatic fever than old Jones criteria. And it is statically significant, P value - 0.001.

5.DIAGNOSIS OF ACUTE RHEUMATIC FEVER USING REVISED JONES CRITERIA VERSUS OLD JONES CRITERIA IN RECURRENCE GROUP

Total number of cases admitted with RECURRENCE – 10 cases

Number of patient diagnosed in recurrence groupusing Revised Jones criteria– 10 cases.

Number of patient diagnosed in recurrence using old Jones criteria- 7 cases.



Bar chart 5 showing diagnosis using revised Jones v/s old Jones criteria in recurrence group.

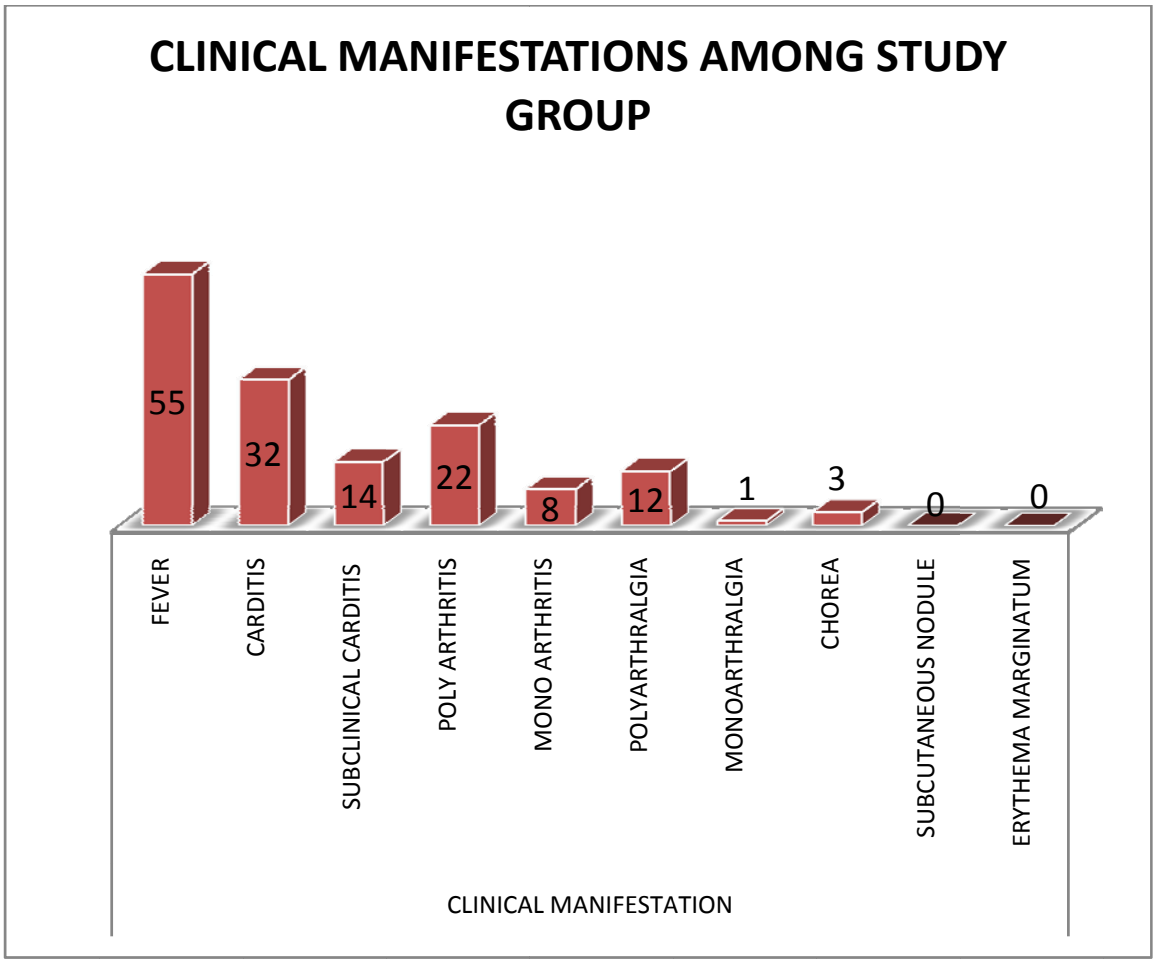
DIAGNOSIS OF RECURRENT EPISODE	REVISED JONES CRITERIA AHA 2015 n (%)	OLD JONES CRITERIA n (%)	P value
	10 (100%)	7(70%)	0.0001

Table5:showing the diagnosis in recurrent episodes group using Revised Jones and old Jones criteria.

Above table clearly shows revised Jones criteria is superior in diagnosing than old Jones criteria in recurrent rheumatic fever group. And it is statistically significant. P value - 0.001.

6.VARIOUS CLINICAL MANIFESTATIONS AMONG STUDY GROUP

Most common clinical manifestation among the study group is fever (55 cases) followed by cardiac manifestations (46cases), joint manifestations (42 cases). No case of subcutaneous nodule or erythema marginatum was found in our study. Carditiswas presented with clinical carditis/ sub clinical carditis. Joint manifestations were presented as arthritis, arthralgia. Chorea was presented in 3 cases.



Bar Chart 6: showing various clinical manifestations among study group

CLINICAL MANIFESTATIONS	NUMBER OF CASES
FEVER	55
CARDIAC MANIFESTATIONS	46
JOINT MANIFESTATIONS	42
CHOREA	3
SUBCUTANEOUS NODULE	0
ERYTHEMA MARGINATUM	0

Table 6: showing various clinical manifestations among the study group

7.CARDIAC MANIFESTATIONS AMONG STUDY POPULATION

Carditis is one of the most commonclinical manifestations seen among study group, Totally 46 cases were diagnosed to have carditis, among 32 (53%) cases had clinical carditis, 14 cases had subclinical carditis.

36 cases (72%) are admitted with first episode. All 10 cases in recurrence group had carditis. Out of 60 cases 14 (23%)cases presented with subclinical carditis (Patient do not have symptoms but echo showed evidence of valvulitis). All the subclinical carditis (14) caseswere diagnosed based on revised Jones criteria 2015 using ECHO.

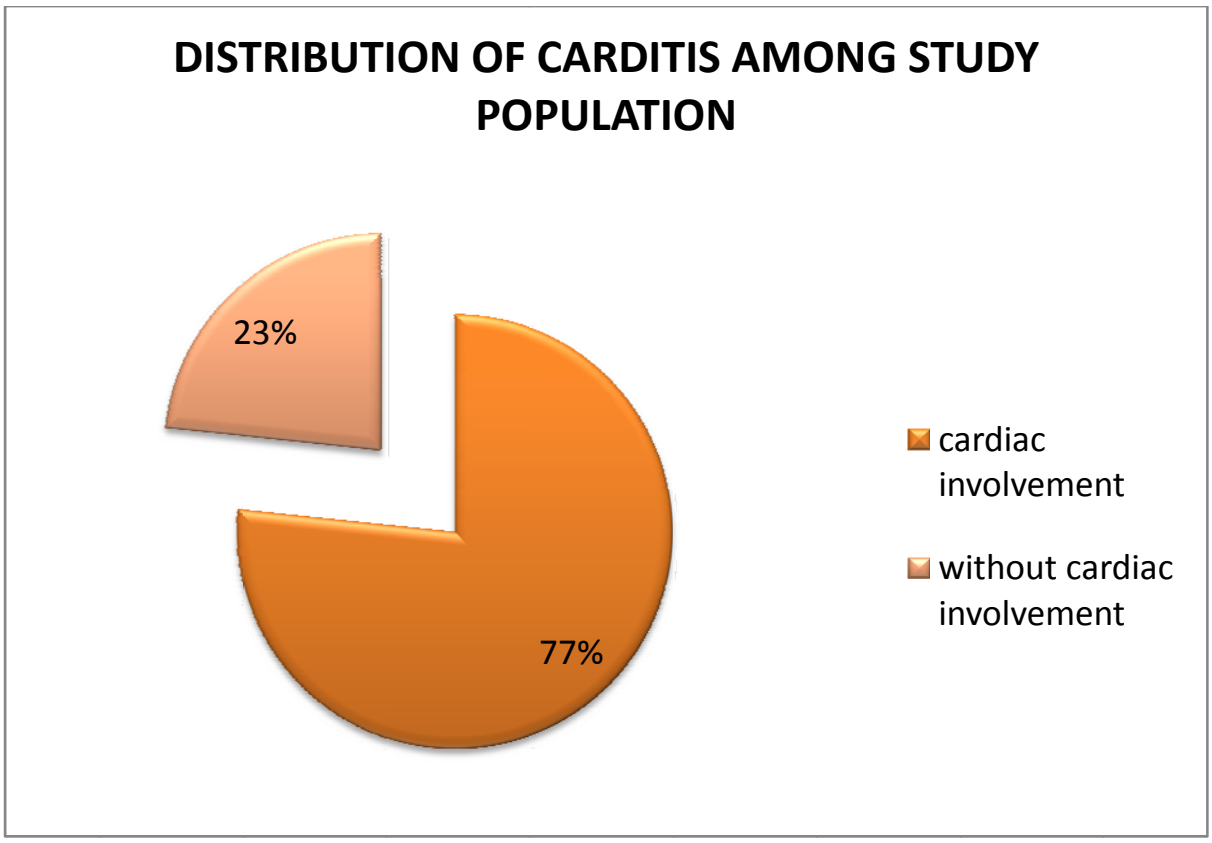


Chart 7: showing cardiac involvement among study population

Clinical carditis was the significant finding (100%) in the recurrence patient, Subclinical carditis was significant finding in first episode. 14 (23%) patients did not show evidence of cardiac involvement on ECHO, from First episode of rheumatic fever group.

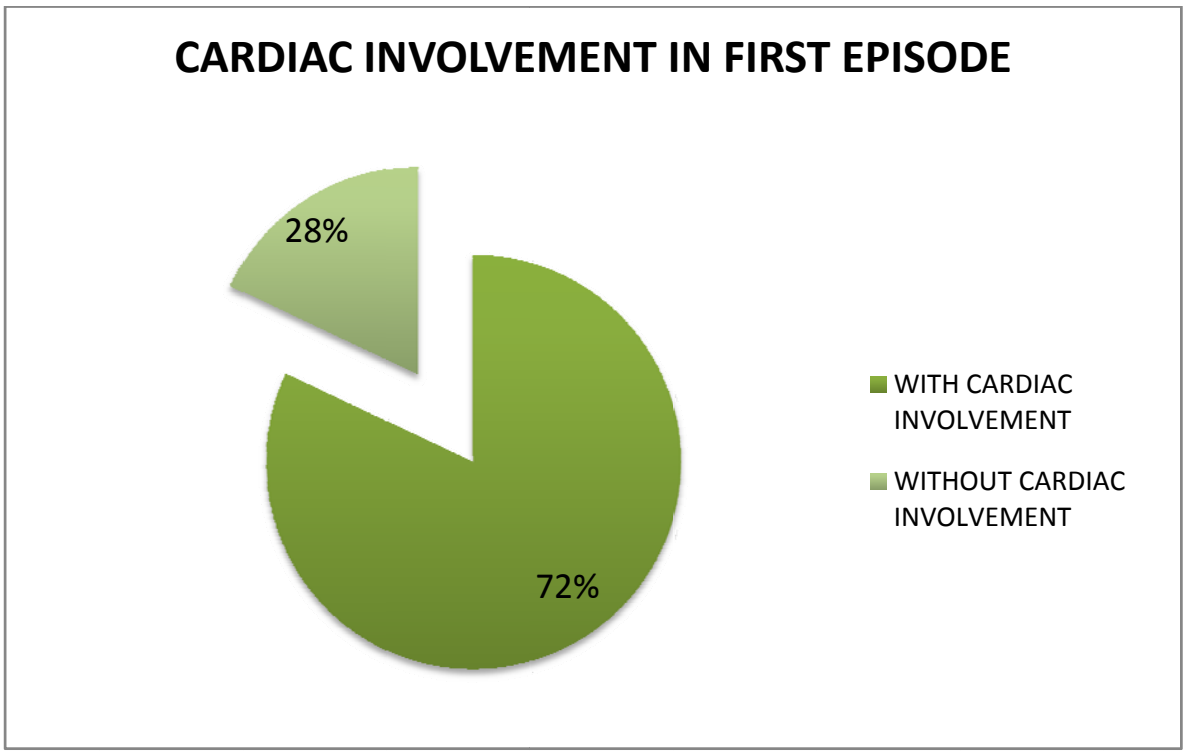


Chart 8 showing cardiac involvement in first episode of rheumatic fever.

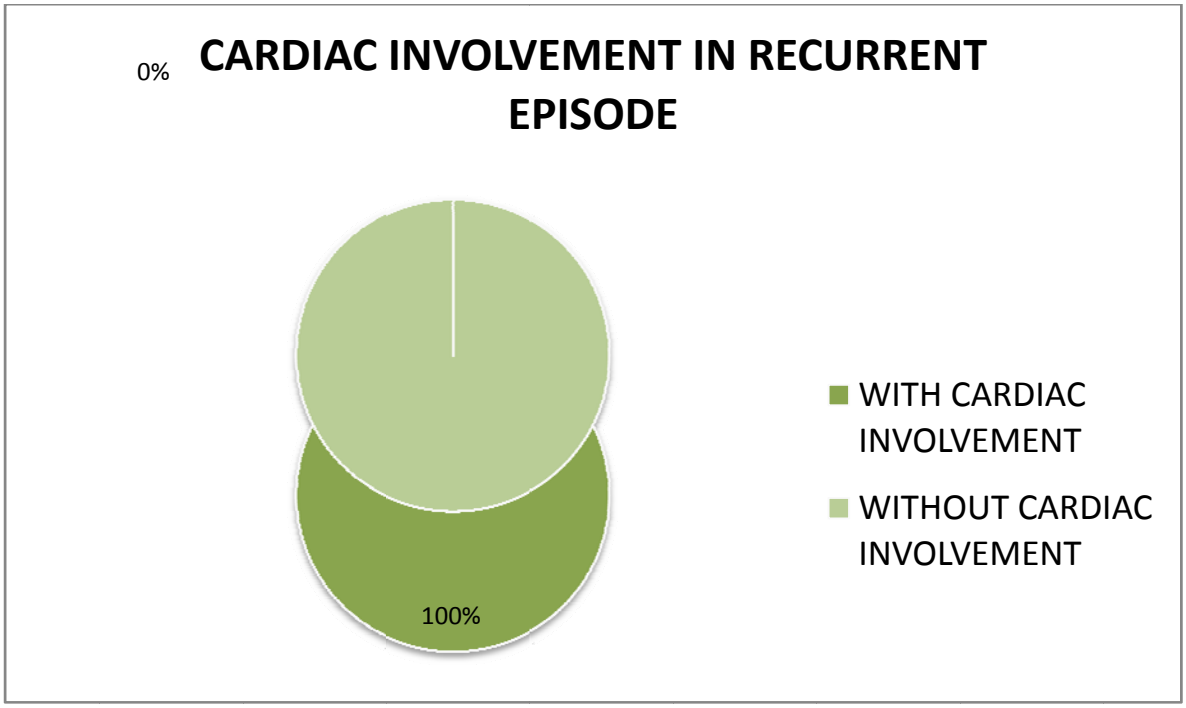


Chart 9showing cardiac involvements in recurrent episode of rheumatic fever

CLINICAL CARDITIS	First episode Number (%)	Recurrence Number (%)	P value
Positive cases	22 (44%)	10(100%)	0.81
Total sample size	50	10	

Table 7 showing clinical carditis between first episode of RF and recurrence

SUB CLINICAL CARDITIS	First episode Number (%)	Recurrence Number (%)
Positive cases	14(28%)	-
Total sample size	50	10

Table 8: showing subclinical carditis between first episode and recurrence

All 14 cases of subclinical carditis presented in first episode of RF, no cases were found in recurrent cases. P value cannot be calculated.

8. JOINT MANIFESTATIONS AMONG STUDY POPULATION

Joint symptoms were next common presentation seen in 42 cases. Among 42 cases 5 were from recurrence group, 37 (88%) from first episode group. Patient with joint manifestation presented with various clinical manifestations such as Monoarthritis 8 cases, Polyarthritis 22cases, Monoarthralgia1 and Polyarthralgia 12cases.Polyarthritis, Polyarthralgia were most common finding. Only one patient presented with monoarthralgia, that too seen in recurrent patient.

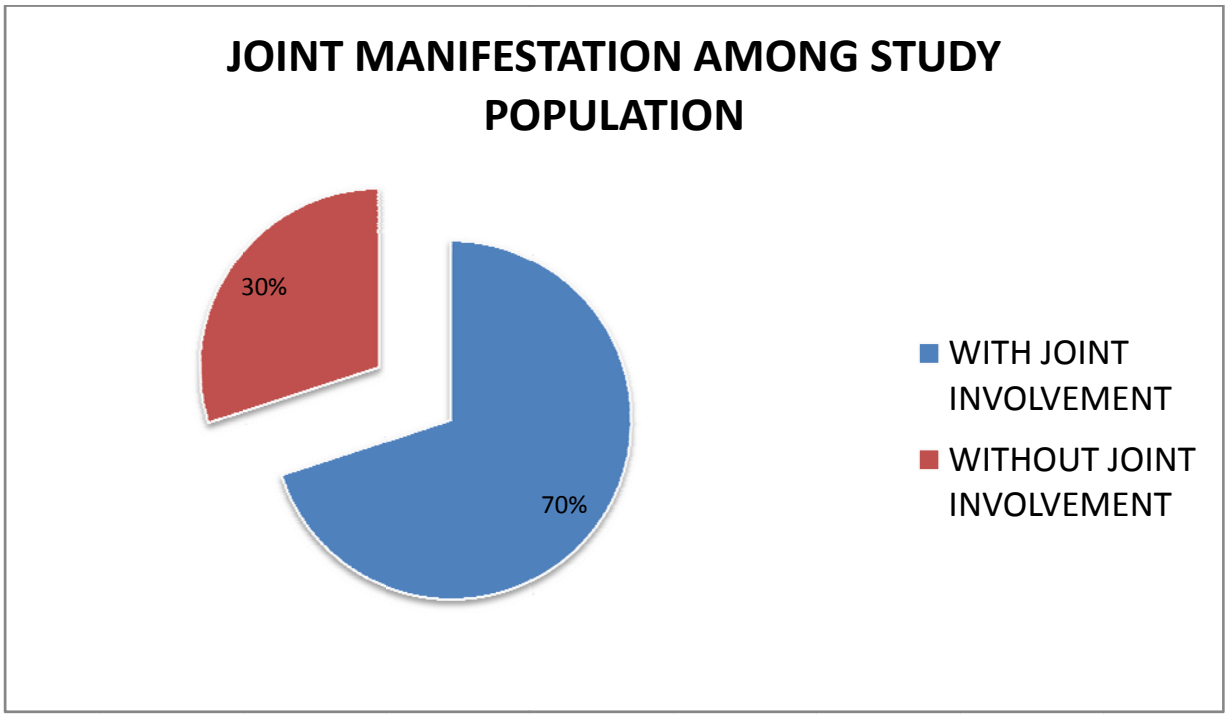


Chart 10:showing distribution of joint involvement in study population

70 % of total study group was admitted with joint manifestations. Using revised Jones criteria monoarthralgia is considered as minor criteria in diagnosis.

JOINT MANIFESTATION	First episode of RF Number (%)	Recurrence Number (%)	P value
MONOARTHRITIS	7 (14%)	1 (10%)	<0.73
POLYARTHRITIS	20 (40%)	2(20%)	0.23
MONOARTHRALGIA	0	1(10%)	-
POLYARHRALGIA	11 (22%)	1(10%)	0.39

Table 9:showing various joint manifestations among study population

In Both the study group distribution of joint manifestations was equal, except Polyarthralgia was more commonly seen in first episode group. Results are not statistically significant.

9. DISTRIBUTION OF CHOREA AMONG STUDY POPULATION

Choreais one of the late manifestations of acute rheumatic fever. All 3 cases were presented in recurrence cases; no case is seen in first episode. All of them had carditis. Out of three chorea patients, two had joint involvement and one had fever.

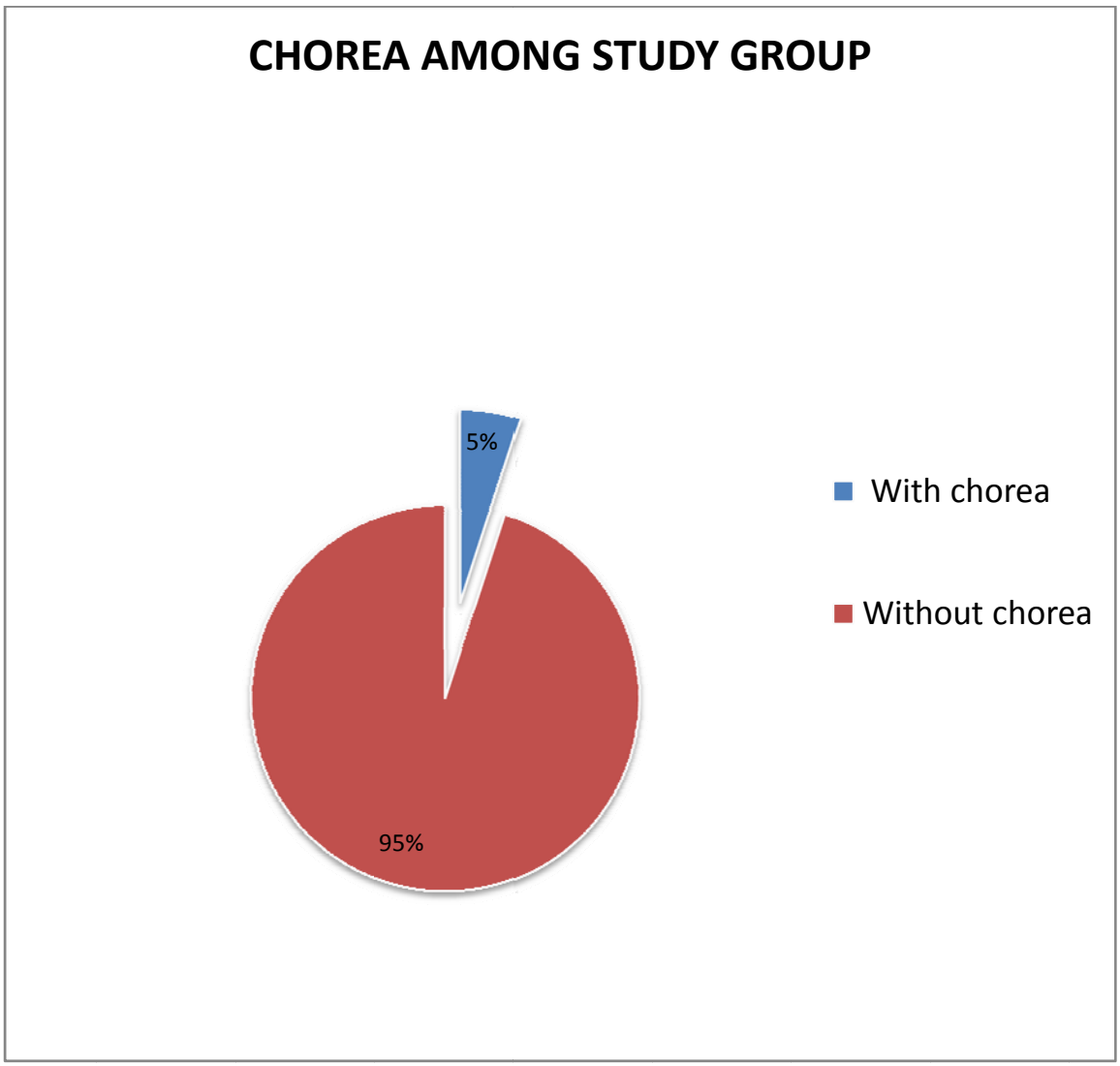


Chart 10: showing distribution of chorea among study group.

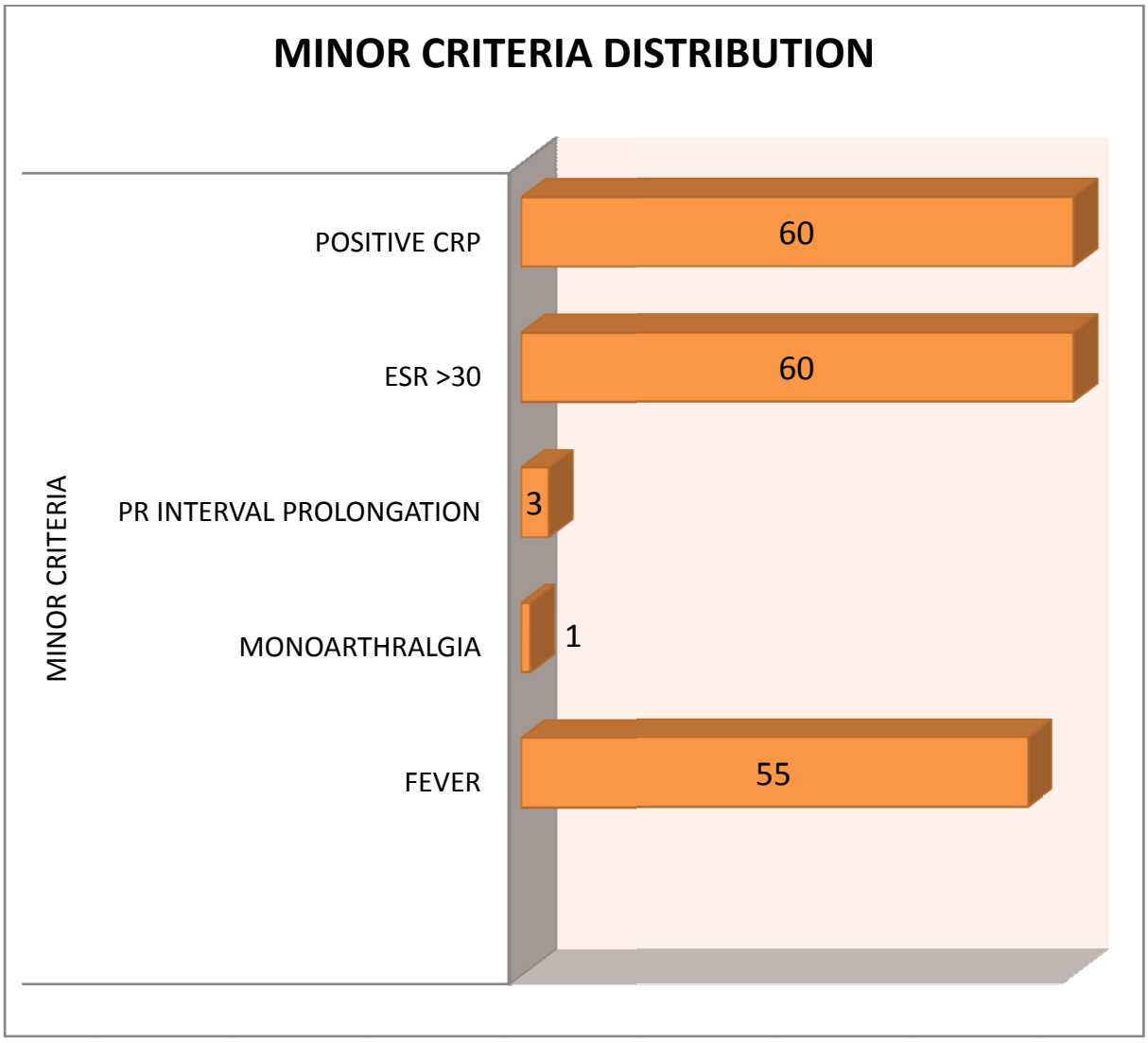
CHOREA	First episode Number (%)	Recurrence Number (%)
Positive cases	0	3
Total sample size	50	10

Table 10:showing distribution of chorea among first episode and recurrence group

No case was presented with subcutaneous nodule or erythema marginatum in our studygroup.

10. MINOR CRITERIA AMONG STUDY GROUP.

In minor criteria fever was the most common presentation. Out of 60 patients, 55 had fever as one of clinical presentations. 91% cases had fever as initial clinical presentation. 3 patients had prolonged PR interval.



Bar chart 11: showing distribution of minor criteria among study population

MINOR CRITERIA	First episode Number (%)	Recurrence Number (%)	P value
FEVER	47 (94%)	8 (80%)	0.14
MONOARTHRALGIA	0	1 (10%)	
PR INTERVAL PROLONGATION	3 (6%)	0	
ESR >30 MM/ HR	50 (100%)	10 (100%)	1.0
CRP +VE	50 (100%)	10 (100%)	1.0

Table 11: showing minor criteria distribution among study group

Irrespective of the episodes whether first episode or recurrence, ESR and CRP was positive in all 60 study population.

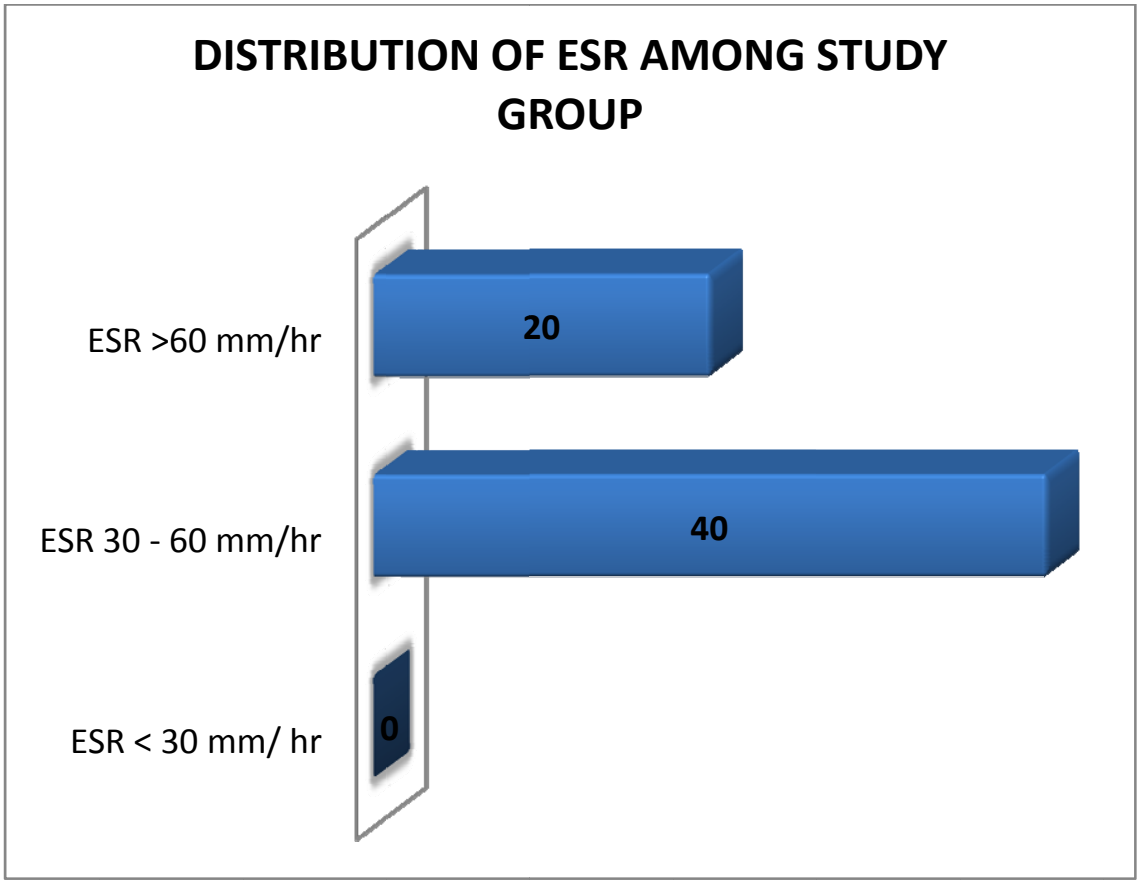
It clearly defines the importance of ESR, CRP in supporting the diagnosis of rheumatic fever.

11. DISTRIBUTION OF ESR AMONG THE STUDY GROUP

The mean value of ESR is 57 mm/hr and the standard deviation is ±16.24. Both the group had similar mean value.

	MEAN ± STANDARD DEVIATION
ESR	57 ± 16.24

Table 12:showing mean value and standard deviation of ESR.



Bar chart 12: showing distribution of ESR among study group

ESR	n (%)
>30mm/ hr	0
30 - 60 mm/ hr	40 (66.66%)
>60 mm/ hr	20 (33.33%)

Table 13: showing distribution of ESR among study group

ASO titre and CRP was positive in all 60 cases.

Throat swab culture was negative in all 60 cases.

12. VARIOUS VALVULAR LESIONS AMONG THE STUDY GROUP

Mitral valve was the most common valve involved. Mitral regurgitation was the most common lesion seen among the study group.

Valvular lesion	First episode (n) TOTAL – 40	Recurrence (n) TOTAL – 20
Isolated MR	25	4
Mild MR	5	0
Moderate MR	24	4
Severe MR	10	6
MR + AR	12	2
MR + TR	2	2
MR +AR+TR	0	1
MR + AR + TR + PR	0	0
Isolated MS	0	0
MS + MR	0	0
Isolated AR	0	0
MR + PHT	1	1
AML , PML thickening	0	5

Table 14: showing various valvular lesions among study group

Aortic regurgitation is the second common isolated valvular lesion. Isolated MR was the significant ECHO finding in single valvular lesion. Mitral regurgitation with aortic regurgitation was the predominant combined valvular lesion.

Combination lesion wasseen in both the group but it was more common in recurrent group than in first episode. Recurrent group had severe valvular lesion compared to first episode. In our study no one had mitral stenosis.

Thickening of anterior and posterior leaflet of the mitral valve seen among 5 cases of recurrence group.

DISCUSSION

In the current study we evaluated the diagnostic yield of revised Jones criteria 2015 in detecting acute rheumatic fever cases. Out of 60 cases, 50 cases were first episode and remaining 10 cases had recurrent episode. When using old Jones criteria, detection rate was only 64% (38 cases out of 60 cases). But while applying revised Jones criteria 2015, detection rate has been increased from 64% to 100%. This was true in both first episode and recurrence group. In first episode RF group, 31 cases out of 50 cases were found out by old Jones criteria, whereas detection of 19 cases was done while using revised jones criteria. In the recurrence group, 3 out of 10 cases were diagnosed using revised Jones criteria. Results of our study concluded that there is an increased detection rate in our population group while using revised jones criteria 2015 in both first episode and recurrence group. It was found out to be statistically significant also with the p value of < 0.0001.

Mean age of distribution in our study was 9.1 years with a standard deviation of 1.699. It was comparable with study done by Saxena et al(10 years) and satoshi sago et al (8 years). It is known that peak age of incidence for acute rheumatic fever in children is 8 years.

Regarding sex distribution, in our study male children (60%) are more affected than female children (40%), but there was no statistical significance. As acute rheumatic fever does not have any gender predisposition.

Regarding various clinical manifestations among studied population.

46 (76%)cases had cardiac involvement including both clinical and subclinical carditis, 42(70%) cases had joint involvement in the form of either polyarthritis, Monoarthritis, Polyarthralgia and Monoarthralgia. 3 cases(5%) had chorea manifestation. Out of 60 cases, none of the cases had erythema marginatum and subcutaneous nodules in both first episode and recurrence group.

In acute rheumatic fever most common manifestations are arthritis and carditis. This is very much correlating with our study population since their most common presentation were carditis and joint involvement. In a study conducted by Dinesh kumar et al carditis contributes about 54%, whereas arthritis contributes 34%, arthralgia was found in 40% cases. In this study also, no one had subcutaneous nodules and erythema marginatum.This is very much comparable with our study. Another study conducted by satoshi et al also had carditis being the most common presentation (61%), followed by arthritis (50%).

Among the cardiac involvement, clinically identifiable carditis was present among 27 cases (54%). Subclinical carditis detected by echo was found in 14 out of 50 cases in first episode RF. These 14 cases of subclinical carditis are of prime importance because these cases would have been missed if we were using only old Jones criteria. Finding out this asymptomatic cardiac involvement is very much necessary as it influences on the long term complication and

prognosis. Patients with carditis in their first episode, likely to have increased cardiac valvular damage during their recurrences. Hence these patients should be treated promptly for the active carditis with anti-inflammatory agents as well as should be started on secondary prophylaxis. Addition of subclinical carditis (detected by Echocardiography) to Jones criteria has an impact on diagnosis as well as on treatment. Clinical carditis was the predominant presentation in recurrence group whereas subclinical carditis was found in first episode group. In recurrence group all had clinical identifiable carditis and which was confirmed by echocardiography also.

Results of our study regarding subclinical carditis correlates well with other studies. For example, in a study conducted by Dinesh Kumar et al, subclinical carditis was present in 38% of cases. Saxena et al screened 6270 children using echocardiography for identifying asymptomatic RHD. He identified 128 cases using echo. This study supports the importance of echo in the diagnosis of ARF.

Another study by Ashwin reddy et al, clinical evaluation detected about 37 cases of rheumatic fever, while Echo along with clinical evaluation detected about 42 cases of rheumatic fever. This study also emphasised the importance of echo while evaluating rheumatic fever.

Second most common presentation was joint involvement (70%).While assessing the joint involvement there were varied presentations which includes polyarthritis, Monoarthritis, Polyarthralgia and Monoarthralgia. In our study

polyarthritis was present in 22 cases(36%), Monoarthritis was present in 8 cases(13.3%), Polyarthralgia was present in 12 cases(36%) and monoarthralgia was present in 1 case(16%). Polyarthritis and Polyarthralgia both (36%) were the most common presentation among the various joint manifestations. If we are taking first episode group, Polyarthralgia contributes to 21 cases out of 50 cases (42%) and polyarthritis contributes to 20 cases out of 50 cases (40%). Whereas in recurrence group out of 10 cases, 2 cases had polyarthritis and 1 case had Polyarthralgia. Next common presentation among joint manifestation was mono arthritis. Mono arthritis in first episode group contributes to 7 cases out of 50 cases (14%), while in recurrence group; it was present only in one case. Monoarthralgia was found in one case that too in recurrence group. This is comparable with the study done by Dinesh Kumar et al, polyarthritis was found in70% cases andMonoarthritis was found in 4%. In our study population, Monoarthritis and Polyarthralgiawere found to be more than in the above mentioned study.

Chorea was the presentation in 3 cases that too in the recurrence group. No one had chorea in their first episode. In the study conducted by Dinesh Kumar et al stated chorea was found in 16% cases of in first episode and 5% cases in the recurrence group.

While assessing the minor manifestations, fever was the most common compliant presented in 55 patients out of 60 cases. Monoarthralgia was taken as

a minor criterion in our study group, as we discussed already it was present in one case of recurrence of RF. Dinesh Kumar et al also had similar results regarding fever, contributing to 68% of cases.

Among the acute phase reactants, ESR elevation > 30mm/hr was considered as minor criteria. The mean ESR among our study was found to be 57 mm/hr with a standard deviation of 16. The lower limit of mean ESR being 41mm/hr and upper limit was 73 mm/ hr. Dinesh Kumar et al study had mean ESR of 44mm/hr. Irrespective of the episode, ESR was elevated in both first episode and recurrence group. In the DineshKumar et al study, high ESR was found in 76% of cases. But in our study, ESR was elevated in all 60 cases. Above 60mm/hr ESR was found to be in 20 cases, whereas remaining 40 cases had ESR between 30 to 60 mm/hr. CRP was positive in all 60 cases both in first episode and recurrence group.

PR interval prolongation was found in only 3 cases in our study population.

In the essential criteria, all suspected 60 cases undergone throat swab culture and ASO titre. None of the cases had throat culture positivity for group A streptococci. ASO titre was the antibody titre test used in our study group. A value of more than 333 Todd units was considered positive. In all 60 cases,ASO titre was positive giving the strong evidence of preceding streptococcal infection. Due to non-availability in our institution, other antibody titres like Anti-DNase were not done. Dinesh Kumar et al did both ASO titre and Anti-

DNase test in their study, which was positive in 60% and 80% respectively. The mean ASO titre was found to be 400 and the mean Anti DNase B was around 667 in the above mentioned study.

In recurrence group, 10 cases were diagnosed. Among the 10 cases, only 5 were on regular secondary prophylaxis, other 5 cases were not having regular compliance. 50% of recurrence cases were due to non-adherence to the drug. But why the other 5 cases who were taking secondary prophylaxis regularly had recurrence needs to be evaluated.

In our study, while identified through clinical evaluation and echocardiography, most common valve to be involved in rheumatic feverwas mitral valve and most common lesion was isolated Mitral regurgitation in both first episode and recurrence group. The most common combined lesion was MR with AR. This correlates well with the study conducted by DineshKumar et al, in that also isolated MR was the most common finding identified in both first episode and recurrence group. In the study conducted by Ashwin reddy et al also concluded that MR was found to be a common manifestation recorded singly or in combination (35 cases out of 42 cases). Isolated MR was found in 10 cases. In this study mitral stenosis was found to be the second most common lesion identified, seen in 29 out of 50 cases. MS was not seen in our study population. Reason in previous study had MS being a finding may be due to the fact that upper limit taken was 16 years. In countries like India earlier onset of MS has

been studied by other studies because of high prevalence and increased recurrences in our population.

CONCLUSION:

In developing countries like India, acute rheumatic fever and rheumatic heart disease still persists. Diagnosing asymptomatic cases and subclinical cases is essential to prevent the morbidity and mortality due to rheumatic fever. By applying revised Jones criteria 2015 in our study group, our detection rate of rheumatic fever has been increased. Inclusion of sub clinical carditis, Polyarthralgia and mono arthritis in major criteria leads to high detection rate of acute rheumatic fever 23%, 20% and 13% respectively. It will not stop at the level of diagnosis alone; this criterion helps in treating in the earlier stage of the disease. Thereby, it helps in reducing the morbidity and mortality by giving secondary prophylaxis.

LIMITATIONS:

1. Sample size in our study was small.

2. Due to non-availability of Anti DNase B in our institution, we could use only ASO titre in the study population for the preceding evidence. In ASO negative cases, a repeat titre was sent. If positive, RF was diagnosed. If negative, cases were evaluated further. This is a major drawback in our study, if

there were two antibody titre measurements, sensitivity would have been increased.

3. In recurrence group, why 5 cases who were on regular secondary prophylaxis developed recurrence pose a big question, it needs to be evaluated further. This was not addressed by our study.

RECOMMENDATIONS:

Improving hygiene, socio economic status and avoiding poverty in developing countries like India will definitely cause a decline in incidence of acute rheumatic fever.

Identifying Group A Beta haemolytic Streptococcal pharyngitis and treating GAS pharyngitis will prevent acute rheumatic fever. As rheumatic fever present in the age group of 5-15 years, Paediatricians are the one who will be seeing the cases for the first time. It is their duty to identify GAS pharyngitis and treating the children with appropriate antibiotics.

There appears to be somehost factors like genetic susceptibility also in the occurrence of rheumatic fever. There appears to be limited data available regarding genetic association. This field has to be explored further through various researches and study; thereby we can easily identify persons who are predisposed.

To pick up asymptomatic RHD cases, there needs to be regular screening program in schools like clinical evaluation, echo screening to find out asymptomatic valvular damage.

Inappropriate use of NSAIDS and inappropriate treatment given by quacks in rural areas misleads the diagnosis away from RF in many cases by stopping the typical presentation of migratory polyarthritis. In such cases with atypical presentation like arthralgia, mono arthritis, a strong suspicion of ARF should be done and needs to be evaluated with appropriate investigations including echocardiography.

There were no national programs for RHD, it has to become as one of the notifiable diseases and appropriate screening programs to be initiated in national level. There were no registry based programs for RHD. Follow up of RF cases who are on secondary prophylaxis is often necessary. Follow up using those registries will ensure strict adherence to the drug and prevent recurrences.

Awareness about acute rheumatic fever among public is very less in the community even among literate people. This has to be increased through media and by doctors. The connection between sore throat and the occurrence of RF and later leading to rheumatic heart disease must be aware among public.

A Multipronged approach needs to be followed from improving living conditions to the implementation of national policies at various levels to prevent and stop the burden of the disease in our society.

Hence,it is the duty of paediatricians to identify rheumatic fever cases early, treat appropriately and start them on prophylaxis. This will prevent a child from becoming an adult with a highly morbid condition - rheumatic valvular disease.

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PROFORMA

- Name : Age/sex:
- Informant : Reliability:
- Complaints:
- Fever : Y/N Duration :
- Sore throat : Y/N
- Joint pain : Monoarthralgia /oligo / polyarthralgia

  Migratory Y/N

  Small/large joints
- Joint swelling: Monoarthritis/oligo/polyarthritis

  Migratory Y/N

  Small/large joints
- Chest pain : Y/N
- Palpitations : Y/N
- Shortness of breath: (PND / ORTHOPNEA): Y/N
- Swelling of legs/abdomen:
- Skin lesion :

- Abnormal movements:
- Prev. h/o rheumatic fever:
- General examination: Fever - 38 * c in high risk population
- Systemic examination –
- 1. CVS - Tachycardia, cardiac murmur, signs of heart failure
- 2. RS –
- 3. CNS –
- 4. Abdomen –

Examination of joints – mono/polyarthritis

ABBREVIATIONS

RF – Rheumatic fever

ARF – Acute rheumatic fever

RHD- Rheumatic heart disease

ASO –Anti streptolysin O

Anti DNase B – Anti deoxyribonuclease B

AHA – American Heart Association

ACC- American college of cardiology

ESR – Erythrocyte sedimentation rate

CRP- C- reactive protein

MR – mitral regurgitation

AR – aortic regurgitation

MASTER CHART

S.NO	NAME	AGE/SEX	CLINICAL PRESENTATION	PREVIOUS H/O RF	ESR	CRP	ASO >333	ECG	ECHO	DIAGNOSIS BASED ON
1	ABITHA	8/FCH	FEVER +, CARDITIS +,	-	34	+ve	+ve		LA dilated, severe MR, mild PHT	
2	SUSHITHRA	8/FCH	POLY ARTHRITIS, CARDITIS	-	36	+ve	+ve		Grade III MR, mild PHT, mild AR	
3	INIYA BALAN	7/ FCH	MIGRATORY POLY ARTHRITIS, FEVER, CARDITIS	-	56	+ve	+ve		Grade III MR,	
4	VASANTH	11/ MCH	POLY ARTHRITIS, FEVER, CARDITIS	-	54	+ve	+ve		Severe MR, Mild AR	
5	PRIYADARSHINI	8/FCH	FEVER, POLYARTHRALGIA, CARDITIS	-	40	+ve	+ve		Severe MR, mild AR	
6	BANUPRASATH	11/MCH	FEVER,CARDITIS,	-	65	+ve	+ve		Moderate MR, Moderate AR	
7	KRISHNAVENI	10/FCH	FEVER, MONOARTHRITIS, SUBCLINICAL CARDITIS	-	40	+ve	+ve		Moderate MR	REVISED JONES 2015
8	SNEHA	7/FCH	FEVER, SUBCLINICAL CARDITIS	-	40	+ve	+ve		Mild MR	REVISED JONES 2015
9	ALAGESAN	12/MCH	POLYARTHRITIS, CHOREA, CARDITIS,	YES	92	+ve	+ve		Severe MR,mildTR,mildPHT,dilated LA	
10	AKASH	12/MCH	FEVER, POLYARTHRALGIA SUBCLINICAL CARDITIS	-	88	+ve	+ve		Moderate MR	REVISED JONES 2015

11	AJU	10/MCH	MIGRATORY POLYARTHRALGIA FEVER, CARDITIS	-	60	+ve	+ve	PR INTERVAL 240MS	Severe MR, Mild AR	
S.NO	NAME	AGE/SEX	CLINICAL PRESENTATION	PREVIOUS H/O RF	ESR	CRP	ASO >333	ECG	ECHO	DIAGNOSIS BASED ON
12	GOWTHAM	10/MCH	FEVER POLYARTHRITIS SUBCLINICAL CARDITIS	-	50	+ve	+ve	-	Moderate MR	Revised JONES 2015
13	CHARLES DANIEL	11/MCH	FEVER CHOREA CARDITIS	YES	45	+ve	+ve	-	AML,PML thickened moderate MR	
14	SHEIK MOHAMMED	10/MCH	FEVER,MIGRATORY POLYARTHRITIS	-	40	+ve	+ve	-	normal	REVISED JONES 2015
15	GANESAN	9/MCH	FEVER MONOARTHRITIS SUBCLINICAL CARDITIS	-	45	+ve	+ve	-	Moderate MR	REVISED JONES 2015
16	MANIKANDAN	9/MCH	FEVER POLYARTHRITIS CARDITIS	YES	70	+ve	+ve	-	Moderate MR, Mild AR PML restricted motility	
17	KARTHIKA	11/FCH	FEVER POLYARTHRITIS	-	35	+ve	+ve	-	Normal	REVISED JONES 2015
18	EMILY	9/MCH	FEVER POLYARTHRALGIA	YES	37	+ve	+ve	-	SEVERE MR	REVISED JONES 2015
19	VEERAPANDI	12/MCH	FEVER CARDITIS	YES	90	+ve	+ve	-	Severe MR Mild TR	
20	UMAMAHESWARAN	9/MCH	POLYARTHRALGIA CARDITIS	-	38	+ve	+ve	-	Moderate MR Mild TR	

21	ROOPAN	7/MCH	FEVER CARDITIS	YES	80	+ve	+ve	Sinus tachycardia LVH+	RHD, Severe MR Mild AR,MILD TR Mild PHT	
22	RAJESHKANNAN	9/MCH	POLYARTHRALGIA SUBCLINICAL CARDITIS	NO	38	+ve	+ve	PR Interval prolonged	Moderate MR	REVISED JONES 2015
S.NO	NAME	AGE/SEX	CLINICAL PRESENTATION	PREVIOUS H/O RF	ESR	CRP	ASO >333	ECG	ECHO	DIAGNOSIS BASED ON
23	KARTHIK	9/MCH	MIGRATORY POLYARTHRITIS	NO	40	+ve	+ve	-	Normal	Revised JONES 2015
24	SHIVAPRIYA	8/FCH	FEVER CARDITIS	NO	98	+ve	+ve	-	Moderate MR, mild AR	
25	NIRMALA	7/FCH	FEVER MIGRATORY POLYARTHRITIS	NO	60	+ve	+ve	-	Normal	
26	KAMALESH	7/MCH	FEVER POLYARTHRITIS CARDITIS	NO	50	+ve	+ve	-	Moderate MR Moderate AR	
27	PAVITHRADEVI	8/FCH	CARDITIS CHOREA	YES	55	+ve	+ve	-	Moderate MR	
28	SADHANA	7/FCH	FEVER MONOARTHRITIS	NO	40	+ve	+ve	-	normal	REVISED JONES 2015
29	SUBASINI	8/FCH	FEVER MIGRATORY POLYARTHRITIS	NO	68	+ve	+ve	-	Normal	
30	VINOTH	10/MCH	FEVER CARDITIS	NO	70	+ve	+ve	Prolonged PR Interval	Severe MR Mild AR	
31	ARUNKUMAR	7/MCH	FEVER MONOARTHRITIS CARDITIS	NO	55	+ve	+ve	-	Moderate MR Moderate AR	

32	PANDI	11/MCH	FEVER POLYARTHRALGIA SUBCLINICAL CARDITIS	NO	48	+ve	+ve		Moderate MR	REVISED JONES 2015
33	KANISHKA	9/FCH	FEVER MIGRATORY POLYARTHRITIS CARDITIS	-	76	+ve	+ve	-	Severe MR	
34	KANNAN	10/MCH	FEVER CARDITIS	-	56	+ve	+ve	-	Moderate MR	
35	AANDISAMY	11/MCH	FEVER MONOARTHRITIS	-	45	+ve	+ve	-	Normal	REVISED JONES 2015
36	ASHOK	10/MCH	POLYARTHRITIS SUBCLINICAL CARDITIS	-	68	+ve	+ve	-	Mild MR	
37	SUGANYA	9/FCH	FEVER POLYARTHRALGIA SUBCLINICAL CARDITIS	-	55	+ve	+ve	-	Moderate MR	REVISED JONS 2015
38	KANAGAPRIYA	11/FCH	FEVER MONOARTHRITIS	YES	50	+ve	+ve	LVH+ Tachycardia	Moderate MR -AML ,PML restricted mobility,thickened	REVISED JONES 2015
39	DEVIPRIYA	12/FCH	FEVER CARDITIS	NO	78	+ve	+ve	Prolonged PR interval	Severe MR ,mild AR	
40	SIVASELVI	10/FCH	FEVER POLYARTHRALGIA CARDITIS	NO	66	+ve	+ve	-	Moderate MR	
41	VIKASH	7/MCH	FEVER MIGRATORY POLYARTHRITIS SUBCLINICAL CARDITIS	-	55	+ve	+ve	-	Mild MR	
42	NAVEEN	8/MCH	FEVER	-	78	+ve	+ve	-	Moderate MR	

			CARDITIS						Trivial AR	
43	INIYAN	11/MCH	FEVER CARDITIS	-	48	+ve	+ve	-	Moderate MR	
44	MANOJ	12/MCH	FEVER SUBCLINICAL CARDITIS	-	50	+ve	+ve	-	Moderate MR	REVISED JONES 2015
45	MADHUMITHAA	9/FCH	FEVER POLYARTHRALGIA CARDITIS	-	70	+ve	+ve	-	Moderate MR	
46	SARANYA	7/FCH	FEVER POLYARTHRITIS	-	44	+ve	+ve	-	normal	
47	ANUPRIYA	12/FCH	FEVER MONOARTHRALGIA	YES	55	+ve	+ve	-	PML restricted mobility Moderate MR	REVISED JONES (3 minor) recurrence
48	ABIRAM	9/MCH	FEVER POLYARTHRALGIA SUBCLINICAL CARDITIS	-	48	+ve	+ve	-	Moderate MR	REVISED JONES 2015
49	SURIYA	8/MCH	FEVER POLYARTHRITIS	-	40	+ve	+ve	-	normal	REVISED JONES 2015
50	PRABHA	7/FCH	FEVER MIGRATORY POLYARTHRITIS	-	78	+ve	+ve	-	Mild MR	
51	KAVIN	10/MCH	FEVER CARDITIS	-	80	+ve	+ve	-	Moderate MR Mild TR	
52	KAVYAPRIYAN	9/MCH	FEVER POLYARTHRALGIA CARDITIS	-	45	+ve	+ve	-	Moderate MR	
53	MARI	8/MCH	FEVER MONOARTHRITIS SUBCLINICAL CARDITIS	-	50	+ve	+ve	-	Mild MR	REVISED JONES 2015

54	LAVANYA	10/FCH	FEVER POLYARTHRITIS	-	80	+ve	+ve	-	Normal	
55	VIKRAM	6/MCH	FEVER MIGRATORY POLYARTHRITIS CARDITIS	-	66	+ve	+ve	-	Moderate MR	
				-						
56	NATHIYA	7/FCH	FEVER, CARDITIS	-	50	+ve	+ve	-	Moderate MR	
57	SURESH	8/MCH	FEVER MONOARTHRITIS	-	60	+ve	+ve	-	normal	REVISED JONES 2015
58	SINDHU	9/FCH	FEVER POLYARTHRALGIA CARDITIS	-	40	+ve	+ve	-	Severe MR, mild AR	
59	ARUN	10/MCH	FEVER SUBCLINICAL CARDITIS	-	50	+ve	+ve	-	Moderate MR	REVISED JONES 2015
60	RAVI	11/MCH	FEVER CARDITIS	YES	68	+ve	+ve	LVH+	Severe MR,PML restricted mobility	

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ETHICS COMMITTEE CERTIFICATE

Name of the Candidate	:	Dr.K.Murugalakshmi @ Chitra
Course	:	PG in MD., Paediatrics
Period of Study	:	2016-2019
College	:	MADURAI MEDICAL COLLEGE
Research Topic	:	Study on effectiveness of Revised Jones criteria (AHA-2015) in detecting acute rheumatic fever cases
Ethical Committee as on	:	16.05.2018

The Ethics Committee, Madurai Medical College has decided to inform that your Research proposal is accepted.

Member Secretary Chairman Dean / Convenor

Prof Dr V Nagaraajan
M.D., MNAMS, D.M., Dsc.,(Neuro), Dsc (Hon)
CHAIRMAN
IEC - Madurai Medical College
Madurai

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INTRODUCTION Acute rheumatic fever is a non suppurative immune mediated reaction secondary to Group A beta haemolytic streptococcus (GABHS) throat Infection. Rheumatic heart disease is becoming a very rare disease in the developed world. However, Rheumatic fever and rheumatic heart disease continues to be a major public health problem in many developing countries like India. The morbidity, mortality and economical losses due to RHD are troublesome in many parts of the country. The morbidity from a single episode of acute rheumatic fever is less severe and rarely it cause death. But the major problem is due to the long term complication of recurrent episodes. This leads to damage to heart valves and development of rheumatic heart disease. As per RHD global status report, around 30 million known to suffer from RHD which is mainly seen in developing countries causing 2,75,000 premature deaths/ year. As per recent studies done at Kerala and Chandigarh incidence of RF in India varies from 0.42 per 1,000 to 11 per 1000 and the prevalence of RHD ranges from 0.56 per 1,000 populations to 11 per 1000. The incidence of RF and prevalence of RHD appears to be less in India. This may be attributable to the fact that certain manifestations which were very common in the past year such as carditis, subcutaneous nodule are less common

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